

78-06

STACKS - S.B.T.



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SAE: Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096. **Order by title and SAE report number.**

TRB: Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

ABSTRACT CITATIONS

SAMPLE ENTRIES

FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number ----- HS-013 124

Title of document ----- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY MALE AND FEMALE DRIVERS**

Abstract ----- The object of this research was to obtain data concerning the maximum amount of brake pedal force that automobile drivers were able to sustain over a period of ten seconds. Subjects were told to apply the brakes in the test car as they would in a panic stop, and to exert as much force as possible on the pedal over the entire ten second test period. A total of 84 subjects were tested, including 42 males and 42 females. The results indicated that there is a wide distribution of values which characterizes the pedal force that the subjects were able to generate. Male subjects produced generally higher forces than did females. Over half the women tested were unable to exert more than 150 lbs. of force with either foot alone, but when both feet were applied to the pedal, force levels rose significantly.

Personal author(s) ----- by C. R. VonBuseck

Corporate author (or author's affiliation) ----- General Motors Corp.

Publication date; pagination ----- 1973? ; 18p

Supplementary note ----- Excerpts from Maximum Parking Brake Forces Applied by Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are included.

Availability ----- Availability: Corporate author

NHTSA accession number ----- HS-018 924

Title of document ----- **NATURAL FREQUENCIES OF THE BIAS TIRE**

Abstract ----- The lowest natural frequencies of a bias tire under inflation pressure are deduced by assuming the bias tire as a composite structure of a bias-laminated, toroidal membrane shell and rigorously taking three displacement components into consideration. The point collocation method is used to solve a derived system of differential equations with variable coefficients. It is found that the lowest natural frequencies calculated for two kinds of bias tire agree well with the corresponding experimental results in a wide range of inflation pressures. Results of the approximate analysis show that the influences of the in-plane inertia forces on natural frequency may be considered small, but the influences of in-plane displacements are large, particularly on the natural frequency of the tire under low inflation pressure.

Personal author(s) ----- by Masami Hirano; Takashi Akasaka

Journal citation ----- Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)

Publication date ----- 1976; 6refs

Availability ----- Availability: See publication

RECENT TRENDS CONCERNING ROAD ACCIDENTS AND BREAKDOWN OF CASUALTIES—YEAR 1975

Statistical data showing recent trends (1970-1975), with emphasis on 1975, in road accidents in member countries of the European Conference of Ministers of Transport (ECMT) are presented in tabular and graphical form. The following countries are represented: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, U.S., and Yugoslavia. The following countries are not represented in the 1975 figures: Denmark, Ireland, Italy, Japan, Portugal, Turkey, and Yugoslavia. Data are provided (1975) on number of killed, casualties and casualty accidents; number of cars; population; and area (sq km). Data are also given on number of killed and casualties 1970-1975 (real figures); number of killed (death within 30 days) and number of casualties (killed or injured), respectively. Number of killed and casualties 1971-1975 as percentages based on 19700100; number of killed and number of casualties, respectively, are provided, as are the number of cars 1970-1975 (real figures) and number of cars 1971-1975 (percentages). Tables provide the number of cars per 1000 population; number of killed per 1,000,000 population; population per sq km; number of killed per 100,000 cars; and number of killed per 1,000 million vehicle (car) km (1975). Other data include a percentage breakdown of killed, by road-user category (pedestrians, bicycles, mopeds, motorcycles, cars (drivers, passengers), cars, buses, other road vehicles, others unidentified) for 1975; a breakdown of casualties, by road-user category for 1975; number of killed per 1000 casualties, all categories combined; and fatal accident risk (coefficient) for each road-user category (1975). Other data include number of killed per 1000 casualties, number of seriously injured per 1000 casualties, and number of casualties per 100 casualty accidents (1975); number of pedestrians killed per 1,000,000 population, number of cyclists killed per 1,000,000 bicycles, number of moped riders killed per 1,000,000 mopeds, number of motorcyclists killed per 1,000,000 motorcycles, number of car drivers killed per 1,000,000 cars, number of car passengers killed per 1,000,000 cars, and number of bus occupants killed per 1,000,000 buses. Number of vehicles per 1000 population, by category of vehicle, and the trend in the number of cars, number killed, and number of casualties for the individual countries are shown.

European Conference of Ministers of Transport, Belgian Delegation
Rept. No. CM(76)39; 1976; 33p
Availability: Reference copy only

HS-022 173

POTENTIAL FOR LUBRICANT-RELATED ENERGY SAVINGS FOR AUTOMOTIVE EQUIPMENT

A summary of testing and results of a synthetic 5W-20 passenger car engine oil developed by Mobil Res. which show the fuel economy benefits of this product are presented. (This discussion is comprised of slide replicas and accompanying narration.) This synthetic engine oil was formulated utilizing base stocks and a specially selected additive system. In addition to providing improvements in fuel economy and oil econo-

my not attainable with conventional mineral oils, this synthetic oil provides excellent performance in critical areas such as wear protection, engine cleanliness, cold starting, and shear stability. Based on 110 comparisons under all types of conditions, the synthetic 5W-20 oil gave an average of 4.2% fuel economy benefit over commonly used reference oils. Allowing for the extra energy needed to manufacture the synthetic oil, for each barrel of synthetic used in place of conventional mineral oil (SAE 10W-40), a savings of 41,000,000 Btu (equivalent to the fuel energy in more than eight barrels of gasoline) is realized. Using longer drain periods for the synthetic would result in even more savings.

by L. W. Manley
Mobil Res., Lubricants and Additives Res. and Technical Service Section
1977; 31p
Presented as part of ERDA (Energy Res. and Devel. Administration)/Mobil Energy Conservation Discussions, 18 Mar 1977.
Availability: Reference copy only

HS-022 174

AERODYNAMIC DRAG REDUCTION OF INTERCITY BUSES. APPENDIX F. SURVEY OF THE LITERATURE AND STATE-OF-THE-ART ASSESSMENT

A comprehensive review of the literature in automotive aerodynamics has been conducted to identify methods of reducing drag of intercity buses. Modifications that offer sufficient promise to be evaluated experimentally are identified. The single most promising approach to reduction of drag involves streamlining the nose contours. The drag reduction might be substantial, but its magnitude cannot be predicted analytically for realistic configurations. Aerodynamic drag reductions approaching 70% (compared to a rectangular body) appear possible if no restrictions are placed on vehicle geometry. Leading-edge vanes may give an appreciable reduction in drag. The reduction cannot be predicted analytically, and scale effects may make it difficult to determine experimentally in wind-tunnel tests. Experimental data concerning air dams and side skirts were found to be in conflict. These items should be tested. Underbody detail should be of minimal importance in model tests of intercity buses. Also, rear-mounted guide vanes, boundary-layer control, or methods to energize the wake offer little or no potential and should not be tested.

by Alan T. McDonald; George M. Palmer
Purdue Univ., West Lafayette, Ind. 47907
1977; 56p 125refs
Availability: Reference copy only

HS-022 175

IMPROVING AUTOMOTIVE FUEL ECONOMY WITH ACCESSORY DRIVES. APPENDIX I

Progress is reported on a research program whose objective is to minimize automotive engine-driven-accessory power consumption, thereby improving overall vehicle fuel economy. (This discussion is comprised of visual-aid replicas and accompanying narration.) The program was initiated in Jun 1974,

with a 12-month study directed toward determining the optimum approach to attaining the objective. Basic conclusions from that initial study were that clipping accessory speed at a selected level will reflect worthwhile fuel-economy improvements, and that a variable-ratio belt is the most appropriate mechanism for clipping or speed limiting. A follow-up development and demonstration program was initiated in Jul 1975 and will extend through Jul 1976. This hardware-oriented phase will involve detail design fabrication and variable-ratio-belt accessory drive development, accessory system installation in the baseline vehicle, and economy-improvement verification. Two types of variable-ratio-belt drives will be investigated during the development program, a closed-loop hydromechanical control, and a direct mechanical control. Development hardware design for both approaches, development hardware fabrication, and all components required for drive installation in the test vehicle are now complete. A baseline car has been selected, procured, and instrumented. Stock vehicle test data required for drive sizing and design have been obtained and include the following: cooling and air-conditioning system performance, power steering and reactor pump load impedance, and electric fan cooling capacity. An accessory test rig is complete and in operation. Performance mapping is complete on the power steering pump and commercial 8-hp constant-speed drive. Finally, a spare V6 engine and accessories have been procured, and dyno checkout runs are in process.

AIRResearch Mfg. Co. of Arizona, Phoenix, Ariz.
Contract ERDA-E(04-3)-1095
Rept. No. AIR-74-310860(16); 1975; 50p
Presented at Energy Res. and Devel. Administration/TEC Contractors Coordination Meeting, Ann Arbor, Mich., 18 Nov 1975
Availability: Reference copy only

HS-022 176

TECHNOLOGIES FOR ROAD TRAFFIC SAFETY. ABSTRACT OF A COOPERATIVE STUDY COMMISSIONED BY THE FEDERAL MINISTRY FOR RESEARCH AND TECHNOLOGY

Future research priorities for road traffic safety as defined by a group of experts are broken down into the following areas: accident data recording and evaluation, human factors, active safety, passive safety, traffic flow, and rescue services. With respect to accident data recording and evaluation, the following three activities require the most attention: improvement of accident data recording technology and the continuation of present accident analyses, systematization and standardization of accident description criteria, and use of new technologies of accident-data recording and better evaluation methods. With respect to human factors, the following areas demand priority treatment: more exact definition of the lower limits of the aptitude of road users, longitudinal-section analysis of driver performance, and examination of all new technologies for safety to determine the extent to which they are made use of by the road user and whether there is in fact an overall safety gain (with particular emphasis on those safety devices which are not accessible to control by the road user but which limit the driver's scope for individual control). Specific areas in active safety, meaning accident avoidance, which require attention include the following: vehicle design (chassis, braking systems, tires, vehicle handling performance) and safety of perception and conditional safety (all those measures which improve conscious perception on the part of the driver and his/her being perceived by others and which are to ensure the driver's

psychomotor performance capability). The paramount aim of passive safety (all technical measures and devices which are apt to keep crash injuries at a minimum) is to ensure crash survivability for all those road users involved in accidents (occupants and pedestrians/cyclists) by adjusting vehicle components such as structure, geometry, and restraint systems to the requirements of biomechanics. Emphasis in the area of traffic flow should be in the following two groups: the current recording, processing, and transmission of traffic data and of the external conditions influencing traffic; and the communication of traffic control measures to the driver (or perhaps the vehicle). With respect to rescue systems, the following are research priorities: rapid information as to the place and type of accident (emergency radio equipment, accident reporting system combined with emergency call stations and distance warning radar); and possibility of the transmission of the vital data of the persons injured to the hospital to help prepare them for rescue transport to, and to prepare the measures to be taken in, the hospital (biotelemetry).

Federal Ministry for Res. and Technology, Federal Republic of Germany
1976; 31p
Availability: Reference copy only

HS-022 177

DO CURRENT LICENSING PROCEDURES SCREEN OUT UNSAFE DRIVERS?

In the first of a series of three articles on driver licensing, the question is raised of whether or not current licensing procedures screen out unsafe drivers. Basic to this discussion is the assumption that it is possible to identify the specific drivers who are going to be unsafe and that these drivers are different enough from the "safe" ones that there is no real problem of overlap. With any screening system it is necessary that there be an arbitrary cutoff point (generally a score of 70% or 75% on a written test of knowledge or a similar score on a rather subjectively scored road test). The two major kinds of errors that are made with such an arbitrary cutoff score are, first, the error of passing someone who should have been failed, and second, the error of failing someone who should have been passed. Where the cutoff point is placed depends to a large extent on the consequences of making the two kinds of errors and the proportion of the population likely to be affected by each. Closely tied to the screening concept is the concept of accident proneness. While there are some persons who are high risks over prolonged periods of time, efforts aimed at their rehabilitation (even if successful) would not make a large dent in the total accident picture. Also, it is necessary not to penalize large numbers of drivers who would not be involved in crashes just because they belong to a high-risk group (e.g. young drivers, diabetics). Realistically, then, driver license programs cannot be expected to screen out bad drivers and allow the good ones to drive. The states may one day find themselves in a position in which they are required to show evidence that their driver licensing procedures are valid. To some extent the driver license programs have been thought of as an educational device (knowledge of traffic safety laws and regulations); at the least the procedure provides the driving public with updated information on traffic laws and regulations. A somewhat different approach to driver licensing would be to establish a much more comprehensive evaluation which would utilize identified key factors of driver performance (e.g. age, driving experience). The various factors could be weighted on the basis of available evidence concern-

ing the strength of relationship to driving. Applicants could qualify for licensure in a variety of ways. A certain minimum score would be required, as well as minimum scores on separate portions of the evaluation.

by Patricia F. Waller
Publ: Traffic Safety v76 n6 p17-8, 35-6 (Jun 1976)
1976

Based on a paper presented at Improving Driver Performance Colloquium, Univ. of Michigan, Hwy. Safety Res. Inst., 1975. Pt. 1 of 3; pts. 2 and 3 are HS-022 178 and HS-022 179. Availability: See publication

HS-022 178

HOW EFFECTIVE ARE DRIVER EDUCATION AND REEDUCATION PROGRAMS?

It is questioned whether the common use of convictions for traffic violations, rather than the involvement in a crash, as a basis for imposing driver improvement measures is defensible. A second consideration is that driver improvement measures are based on the absolute number of infractions with no attention given to the amount of driving involved. The driver improvement programs consist of the following three stages: a warning notice sent to a driver who has committed a certain number of violations (or accumulated a certain number of points against his/her record); if no improvement evidenced, then a personal conference with a driver licensing agency representative; and, finally suspension or revocation of license. The first stage has been shown to be remarkably effective, but the second and third stages have been unsuccessful. The driver licensing agency's representative stage should be reexamined with an eye toward what can realistically be accomplished in the brief encounter between hearing officer and driver, in which a review of the driver's violations and a discussion of some of the possible contributing factors usually take place. From observations of interviews and hearings, it is concluded that in a significant proportion of the cases, the problem is much more basic than poor driving and the driving is simply symptomatic of other difficulties the driver is experiencing. With respect to driver education (referring to programs offered in the public schools), the instructor should be responsible for how well the student is able to operate the vehicle and how well he/she knows the rules of the road; however, whether the skill and knowledge are used depends on many factors beyond the instructor's control. It is ridiculous to expect a teacher to change the attitudes of students in 36 hours (6 behind the wheel) of contact (minimum amount of instruction required by Federal standard). Neither driver improvement nor driver education instruction is of sufficient length to be expected to have any significant impact. A graduated system of licensing as a cooperative effort involving driver licensing personnel and parents or other responsible adults would be a better alternative to the present system. In this case the driving process would begin with the student at the age of 14 or 14 and a half and would involve the student being accompanied by a responsible adult and driving only at certain times of the day. This training would move onto higher levels of skill until the driver would receive a fullfledged license.

by Patricia F. Waller
Publ: Traffic Safety v76 n7 p22-4, 37-9 (Jul 1976)
1976

Based on a paper presented at Improving Driver Performance Colloquium, Univ. of Michigan, Hwy. Safety Res. Inst., 1975. Pt. 2 of 3; pts. 1 and 3 are HS-022 177 and HS-022 179. Availability: See publication

HS-022 179

CHALLENGING THE STATUS QUO IN DRIVER LICENSING

The following aspects of driver licensing are questioned in outline form: psychometric properties of the measuring instruments being used, the impact on accidents of the implementation of special licensing programs (e.g. for operators of motorcycles and large trucks), consideration of exposure in evaluating driver licensing and driver improvement programs, implications of poorer driver records for those having or potentially having higher measures of performance, cost/benefit ratios of diagnosis and remedial programs, the usefulness of implementing a number of types of licensure based on the demonstrated ability of the driver, the merits of the master driver license whereby drivers receive special recognition for "clean" driving records, basing driver improvement programs on crashes rather than convictions for violations, special consideration in driver improvement programs to professional drivers, the extent to which incentive programs or driver improvement programs that are based on convictions for violations merely provide increased business for attorneys rather than affect actual driving performance, the extent to which driver programs could be coordinated, and the extent to which driver education programs could be coordinated with driver licensing in an effort to bring young drivers into the driving program gradually. It is questioned whether highway safety goals might better be served by taking the vast amounts of money invested in highway safety programs (driver licensing, driver improvement, driver education) and redirecting it into such activities as removing roadside booby traps and promoting mandatory seatbelt usage.

by Patricia F. Waller
Publ: Traffic Safety v76 n10 p20-1 (Oct 1976)
1976

Based on a paper presented at Improving Driver Performance Colloquium, Univ. of Michigan, Hwy. Safety Res. Inst., 1975. Pt. 3 of 3; pts. 1 and 2 are HS-022 177 and HS-022 178. Availability: See publication

HS-022 180

SAFETY BELT USAGE IN THREE MICHIGAN CITIES. BEFORE AND AFTER STUDIES TO DETERMINE THE EFFECTIVENESS OF MVMA [MOTOR VEHICLE MANUFACTURERS ASSOCIATION] SAFETY BELT MASS MEDIA CAMPAIGN

Safetybelt usage among drivers in three Michigan cities (Detroit, Traverse City, Marquette) before and after the initiation of an advertising and publicity campaign to promote the use of safety belts was determined in order to assess the effectiveness of that campaign. The results were as follows: Detroit, 3921 (before), 7754 (after); Traverse City, 5142 (before), 4368 (after); and Marquette, 4803 (before), 4172 (after). The "before" study was conducted during the period 18-28 Aug 1977, inclusive; the "after" study was conducted during the period 1-14 Nov 1977, inclusive. The mass media campaign covered only two months, Sep and Oct 1977; and a longer or different campaign might have achieved more positive results. For all types of safetybelt systems combined, usage in terms of both full protection and some protection was almost identical both before and after for each of the three cities. The level of usage, both before and after, was highest in

Traverse City and lowest in Marquette. Usage was highest in the most recent model cars, and lowest in the older models which have only the lap belt. Usage was intermediate for systems in which the lap belt and shoulder harness are separate.

Opinion Res. Corp., Princeton, N.J. 08540
Contract DOT-HS-7-01736
1977; 6p
Availability: Reference copy only

HS-022 181

SAFETY BELT USAGE: SURVEY OF THE TRAFFIC POPULATION (AUGUST, 1976 - MARCH, 1977). PRESENTATION CHARTS

Statistical data on safetybelt usage in various cities throughout the U.S. for the period Aug 1976-Mar 1977 are presented in tabular and graphical form. Safetybelt usage was monitored on a continuous basis by observing drivers of passenger cars (1964 and later model years only) as they stopped for red lights at traffic intersections in the following cities: Atlanta, Baltimore, Birmingham, Boston, Chicago, Dallas, Fargo-Morehead, Houston, Los Angeles, Minneapolis-St. Paul, New York, Phoenix, Pittsburgh, San Diego, San Francisco, and Seattle. The findings are presented in the following categories: overall safetybelt usage, total usage by month, usage by safetybelt system, usage by model year, usage by model year (for each study month), usage by manufacturer (all model years), usage by manufacturer (1976-1977 cars), usage by car make (1976-1977 cars), usage by major car models, usage by car style, list of models within car styles, usage by two-door and four-door cars by manufacturer, safetybelt usage by region, usage by road type, usage by sex and age of driver, usage by time of day, head restraint position (19690 models), correct head restraint positions by car make, and safetybelt usage by head restraint position. Overall safetybelt usage was found to be 18.5%: 11.7% for both lap and shoulder belts in use and 6.8% for lapbelt only in use.

Kirschner Associates, Inc., 733 15th St., N.W., Washington, D.C. 20005
Contract DOT-HS-6-01340
1977; 58p
Availability: Reference copy only

HS-022 185

SOUTHWEST CONFERENCE ON COORDINATING MOBILITY PROGRAMS FOR THE TRANSPORTATION DISADVANTAGED. PROCEEDINGS, SAN ANTONIO, TEXAS, FEBRUARY 1-3, 1977

The presentations, workshop reports, and recommendations passed by the conferees are presented. The transportation disadvantaged is a group of people which includes the elderly, the handicapped, and those with low income. The subjects covered in the presentations include Federal and state policy on coordination of transportation services, the barriers to coordinated transportation services, problems caused by the lack of coordinated services, potential solutions to the problem of insufficient coordination, the available agency resources for extending or coordinating existing and future services, and specific program alternatives for establishing coordinated services. The viewpoints of various human services agencies, the

Dept. of Transportation, and public and private providers are presented in these proceedings.

by John W. Huddleston, ed.
University of Texas at Austin, Council for Advanced Transportation Studies, Austin, Tex. 78712
Rept. No. DOT-TST-77-84; 1977; 282p refs
Sponsored by Texas Dept. of Community Affairs, Texas Dept. of Public Welfare, National Council for the Transportation Disadvantaged, Council for Advanced Transportation Studies at Univ. of Texas at Austin, and Dept. of Transportation.
Availability: NTIS

HS-022 186

SPEED LIMITS SAVE LIVES...AND CASH

A theory is presented for discussion at the Inst. of Traffic Administration Conference in Leicester (England) by Dr. Clifford Sharp, Reader in Transport Economics at Leicester Univ., that cost benefits can result from the imposition of speed limits. By imposing speed limits on hitherto unrestricted roads or lowering existing speed limits, the following benefits would result: reduction in accident rates, reduced vehicle operating costs, savings in fuel consumption, reduction in environmental costs, reduction in road construction costs, and reduction in vehicle manufacturing costs. Statistics are presented which show that the reduction in speed limits during the oil crisis of 1973-1974 led to a fall in accident rates. It is questioned whether the planned return to the pre-fuel-crisis speed limits is in the public interest and whether, if the trade-off between reduced journey times and the probability of being involved in a traffic accident could be presented clearly for public discussion and decision, there would be a majority in favor of the higher speed limits.

Publ: Commercial Motor v146 n3727 p66-7 (28 Oct 1977)
1977; 4refs
Availability: See publication

HS-022 187

CAR THEFT

The car thief is described and steps one can take in an effort to deter this criminal are outlined. One in every 128 automobiles registered in the U.S. is stolen, and public apathy is the main problem in averting these thefts. About three quarters of all auto thefts are the work of the joyrider; the rest fall into the hands of the professionals. The police profile of the joyrider is that of an amateur out for kicks; the odds against this person serving time for this grand larceny are 76 to 1, so the joyrider often steals again and again. Like all professionals, the full-time auto thief is not easily stopped. Unlike the joyrider, the professional is taking a car for the monetary gain. The following are some options to take to make it difficult enough for the professional thief so that he/she will seek an easier victim: prominently display decals forewarning thieves that your car is protected by antitheft devices (even if you do not have any); install slim, tapered door lock buttons on all doors, and lock them even when away from the vehicle momentarily; install different locks for the door and the ignition switch, if the car is not already so equipped; buy the standard micro-switch burglar alarm units for sale for \$50 or less, if you have the mechanical ability to install it yourself; get hood and trunk chain locks which cost around \$5 and are easily fitted to most autos; check out the various kill switches on the market which can act as second ignition or second fuel

switches and which cost \$10 to \$30 and can be installed by yourself or at a retail store; and look for steering wheel locks which connect the steering wheel to the clutch or brake pedal and cost between \$15 and \$20. Also the following steps should be taken to help prevent your car from being stolen: always park in a well lighted, traveled area; keep the windows tightly closed; never leave the keys in the car; always lock the car; keep valuables out of plain sight; install slim, tapered door lock buttons; and think of investing in a kill switch.

by James J. Lawrence
 Publ: Driver v11 n5 p8-12 (Oct 1977)
 1977
 Availability: See publication

HS-022 188

AUTOMOBILE INSURANCE COVERAGE

The types of automobile insurance coverage are as follows: liability (specific amount coverage which protects one against claims for damage or personal injury caused by his/her car), medical payments (specific amount coverage which pays the costs of any medical expenses one incurs resulting from a vehicle accident), comprehensive (protects one's vehicle against all losses with the exception of those involving collision (e.g. theft, vandalism, fire, and storm damage), and collision (protects the car itself for damages received in an accident, usually with the insured paying a deductible amount and the insurer covering all expenses over and above that amount). Insurance does not cost the same for everyone; it is based on a group rate setting (which is based on the accident records for a group of people with similarities in age, sex, territory of residence, marital status, driver education, etc.). The maximum rating factors are established by each State's Insurance Board and are not negotiable between the insurer and the insured. Nevertheless, there are discounts available which are based on a good-student rating, a Driver Training Certificate, marital status, and driving record. A policy with higher deductible amounts for collision or comprehensive coverage can be beneficial for safe drivers. Another area of great significance in considering car insurance is the concept of no-fault insurance which basically allows an insured motorist to collect on personal injury claims no matter who is at fault, these claims to be paid by the individual's own insurance company. At present 24 states have some form of no-fault insurance laws, 16 of which have bonafide compulsory no-fault legal requirements for drivers with a vehicle registered in that state. In Jun 1977 the Dept. of Transportation issued the results of a study of the 16 no-fault states which concluded the following: no-fault insurance does work, benefits are more adequate and equitable, payments are more prompt, cost efficiency of administering auto insurance benefits has improved, and the burden on the courts and lawyers has been reduced as litigation has declined. The opponents of no-fault, meanwhile, claim that the rising premium rates in no-fault states prove that this system is no better than the old fault system. Federal no-fault auto insurance legislation was first introduced seven years ago; no proposal yet has come close to being enacted into law.

by James J. Lawrence
 Publ: Driver v11 n5 p16-20 (Oct 1977)
 1977
 Availability: See publication

HS-022 189

RIGHT TURN ON RED--A TRAFFIC MANAGEMENT SIMULATION

A stochastic model of the right-turn-on-red (RTOR) policy for a high-density urban area consisting of one-way streets is outlined. This model is used to investigate the effects of cross-street traffic volume, right-turn lane traffic volume, pedestrian arrival rate, and balking rate for right-turning vehicles. The model provides the methodology for studying the RTOR maneuver under various conditions. From the results of analyzing the model with a simulation program, specific criteria were developed for using RTOR to reduce delay time at intersections, the benefit of RTOR on which this study was concentrated. First, the maneuver should result in an average savings of at least 20% in waiting time at the intersection. And second, when the parameters (distance between intersections on main street, signal phasing, travel time between intersections, starting time, interval vehicle gap, right-turn gap, main-street interarrival time, side-street interarrival time, balking rate, pedestrian rate, pedestrian crossing time) are close to their standard values, certain conditions should hold for the intersection in question. The first condition is that the balking rate (the fraction of right-turning motorists who decide not to use the option of RTOR) should not exceed 0.6; in certain cases this would mean that a special lane must be provided for right-turning vehicles. The pedestrian rate should not exceed 0.3; this corresponds roughly to a pedestrian volume of ten per minute. The maneuver is not recommended when the rate of arrivals in the right-turn lane exceeds nine vehicles per minute. Finally, the traffic rate in the rightmost lane of the main street should not exceed 15 vehicles per minute. A combination of relatively high volume and high balking rate may render the RTOR maneuver impractical, even though all values may still be within the above guidelines. A number of the parameters were not analyzed; these include the length of the red-light and green-light phases, synchronization of traffic lights along the main street, and interference by pedestrians crossing the main street.

by Gideon Lidor; Richard Wiener
 Publ: Simulation v29 n6 p198-203 (Dec 1977)
 1977; 9refs
 Availability: See publication

HS-022 190

ECONOMICS OF SAFETY AND SEAT BELT USE

Following the theoretical model of individual consumption and lifesaving activity, and using the variables for seatbelt productivity, cost of seatbelt use and value of life available in A Panel Study of Income Dynamics, 1968-1974, by the Survey Res. Center, Inst. for Social Res., Univ. of Michigan, seatbelt use was studied statistically through multivariate probit analysis. The analysis of automobile lap seatbelt use of over 1800 drivers located throughout the U.S. yielded statistically significant and reasonable results in which seatbelt use or nonuse was correctly predicted for 77% of the drivers. Use of seat belts was expected to be greater when the productivity in preventing injury was greater. Seatbelt productivity variables found to be important were age of driver, male sex, and rural speed limit, all of which increased seatbelt use. Use was also expected to be greater when the value the driver places on his/her life is greater. Future labor earnings and health were thus found to significantly increase seatbelt use. Higher costs of using seat belts were expected to reduce seatbelt use. In-

convenience) is imperative in formulating any successful safety regulation.

by Glenn Blomquist

Publ: Journal of Safety Research v9 n3 p179-89 (Dec 1977)

1977; 30refs

Availability: See publication

HS-022 191

RISKS ASSOCIATED WITH DEFECTIVE TIRES

Empirical data from four regional surveys are used to determine the probabilities of vehicle accidents due to tire failure. The data sources are as follows: a series of studies conducted by the Traffic Inst. of Northwestern Univ. on tire disabilities and their relationship to automobile accidents on the Illinois Tollway during the period Sep 1966-Aug 1967; Hwy. Safety Res. Inst. Survey of vehicle accidents in Texas from 1969 through 1973 as reported by the Texas Dept. of Public Safety; a survey conducted by the California Hwy. Patrol of accidents occurring in non-urban areas of the state between 1 Aug 1965 and 31 Jan 1966; and the New York Thruway Authority Annual Rept. of 1968. The probability of an accident from systematically induced failure is then estimated using tire warranty claims and the tire failure cause data. Estimates of accident frequency due to manufactured-in defects range from 150 to 5900 per year, involving from two to 85 fatalities, when determined by various methods from the regional data sources available. Within this range, the best estimate of annual fatalities caused by defective tire failure is shown to be between 40 and 50 with regional variation within a factor of four on the low end and two on the high end. Mean difference comparisons of the regional data sources were done to determine the quality of the data and to ensure that comparison of these data was valid. Part of the variance in regional results can be attributed to differences in methodology.

by A. J. Unione; R. C. Erdmann

Publ: Journal of Safety Research v9 n3 p108-19 (Sep 1977)

1977; 29refs

Availability: See publication

HS-022 192

TESTS FOR GLARE SENSITIVITY AND PERIPHERAL VISION IN DRIVER APPLICANTS

Field trials are reported of a version of the standard driver vision tests modified to provide both a quantitative measure of susceptibility to glare and defects in peripheral vision. Approximately 1500 driver applicants were examined in 30 stations throughout North Carolina. The distribution of elevated glare sensitivity and defects in peripheral vision in the driving population were determined and correlated with individual accident records. There were clear indications that a large percentage of older drivers had elevated glare sensitivity. Those drivers limited their driving to nonglare conditions in many cases. Future lines of investigation indicated by the present study are a correlation between this test and the present standard used by the Medical Evaluation Board for restriction to daytime driving. The Bausch and Lomb Orthoraters with the glare sensitivity test incorporated as in the present trials appeared

by a specialist. It was found that when drivers with impaired peripheral vision have accidents their visual defect seems to be a significant factor. The sector peripheral vision tester used in these field trials performed satisfactorily and reliably. On the basis of previous standards and the present trials, a reasonable requirement for peripheral vision would be 55° temporal and 30° nasal in each eye, or 70° temporal and 30° nasal in at least one eye. Such a requirement, it is felt, should be considered by the Medical Evaluation Board; and the peripheral vision tester, as used in these trials or one of a similar design, should then be adopted for use by the North Carolina Dept. of Transportation for driver applicants, with the peripheral field positions specified at 85°, 70°, and 55° temporal, and 35° nasal for each eye. The driver education program should include some material for drivers with increased glare sensitivity or restricted peripheral vision to make them aware of their problem.

by Myron L. Wolbarsht

Publ: Journal of Safety Research v9 n3 p128-39 (Sep 1977)

1977; 15refs

Availability: See publication

HS-022 193

DOE [DEPARTMENT OF ENERGY] GEARS UP FOR ELECTRIC CAR PROGRAM

The Dept. of Energy's (DOE) electric car demonstration project started this year with 200 to 400 vehicles and plans to add several hundred more each year, a total of 7500 commercially built electric vehicles will be in use as taxis, rental cars, utility trucks, retail delivery vans, etc., by 1984 if a revised demonstration schedule now pending in Congress is passed. The demonstration project was written into law last year in the Electric and Hybrid Vehicle Res., Devel. and Demonstration Act of 1976, the idea of the project to convince the public that electric and hybrid vehicles offer a viable alternative to conventional vehicles. It is felt that the revised schedule would allow DOE to support the project wholeheartedly, manufacturers to incorporate improvements in later models, and time for support services to be in place to take care of the vehicles. The U.S. electric vehicle industry today consists of a few small firms with very limited production capacity; the required infrastructure of spare parts suppliers, repair stations, battery service facilities, and trained maintenance personnel is largely nonexistent. DOE will share the costs of the project with the participants who will be selected early this year and who will consist of either an established business (e.g. phone company or large department store) or a business with previous automotive experience that could serve in a capacity analogous to a car dealership. Electric vehicles are likely to fail miserably unless DOE backs them up with extensive research. The key word in electric vehicle research is battery, and DOE has commissioned two companies to design and build a prototype auto powered by advanced lead-acid batteries, which are already available in prototype. No matter what the outcome on the technical side of battery research, the key issues involved on the nontechnical side are health and safety. A DOE report analyzes the problems associated with all the batteries now under development. One problem is the introduction of nickel into the general environment by the extensive use of nickel-

HS-022 194

ESTIMATION OF THE FATIGUE CRACK INITIATION LIFE IN WELDS USING LOW CYCLE FATIGUE CONCEPTS

An analytical model for calculating the fatigue crack initiation life of welds has been developed. In order to use the model, the stresses and strains at the critical location (toe of the weld) and a mechanics analysis to relate these local stresses and strains to the remotely applied stresses and strains are needed. Computation of the local stresses and strains was performed using Neuber's equation, and the fatigue behavior of the material at the critical location was computer simulated using a rheological model. Verification of the model was accomplished by comparing fatigue crack initiation life predictions with data obtained by testing simulated weld specimens and by utilizing data from the literature for several notch geometries, materials, and fatigue loading conditions. The results of these comparisons indicate that a very good estimate of the fatigue crack initiation life can be obtained if the material properties at the critical location are well known. Based on the analytical model developed, an analysis of the factors influencing the fatigue crack initiation life of welds was made. The results of this analysis indicate that the fatigue crack initiation life of welds is influenced by the microgeometry and macrogeometry of the weld reinforcement, the residual stresses, and very markedly by the material properties. It also indicates that the fraction of the fatigue life spent in fatigue crack initiation is dependent on the material and on the fatigue regime under consideration.

by R. J. Mattos; F. V. Lawrence
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Metallurgy and Mining and Engineering, Urbana-Champaign,
Ill.
Rept. No. SAE-SP-424; 1977; 62p 97refs
Sponsored by Univ. of Illinois Fracture Control Prog. and the
Dept. of Metallurgy and Mining Engineering.
Availability: SAE

HS-022 195

THE AUTOMOBILE INDUSTRY IN 1976: AN INTERNATIONAL SURVEY. FINAL REPORT. STAFF ECONOMIC REPORT

Developments in the automobile industries of the U.S., Canada, Japan, Germany, France, the United Kingdom, Italy, and Sweden during 1976 are examined. The analysis focuses on passenger car registrations, production, exports, and imports in each of the eight major producing countries (85% of free world auto production), placing 1976 events in the context of trends developing in earlier years, particularly the period since 1973. Numerous tables and graphs supplement the text. Overall, the major auto industries experienced signs of recovery in 1976. Following two years during which demand for passenger cars sharply contracted and production of passenger cars was curtailed, the major auto producers witnessed

increase over previous years. The degree of recovery experienced in 1976, however, was not equally distributed among the major producers. Also, the improvement in 1976 was not sufficient in many cases to return car production, registrations, and trade to the levels attained in the all-time record year 1973. Thus, in spite of the substantial improvement achieved in 1976, most of the major producers were still operating at or below levels attained three years earlier.

by Kay R. Kuhlman
Domestic and International Business Administration, Office of Economic Res., Room 2039, Dept. of Commerce, Washington, D.C. 20230
Rept. No. ER-23; PB-272 284; 1977; 80p
Rept. for 1976.
Availability: NTIS

HS-022 196

ASSESSMENT OF RESULTS OF BRAKE TESTS WITH REGARD TO UNIFORMITY BETWEEN RIGHT AND LEFT WHEELS OF MOTOR VEHICLES (BEWERTUNG DER MESSERGEBNISSE VON BREMSPRUFUNGEN BEZUGLICH DER GLEICHMASSIGKEIT ZWISCHEN RECHTEN UND LINKEN RADERN VON KRAFTFAHRZEUGEN)

A study was undertaken to ascertain to what degree values allowed in current mass tests of motor vehicles for braking-force unevenness of 30% (roller-type tests stands) or 20% (plate test stands) on the right and left on a single axle are justified. Numerous brake tests were conducted using an experimental vehicle equipped with instruments for setting unequal braking forces and for measuring shifts of the vehicle path. The test program emphasized the study of the effect of braking-force unevenness in the wheels of the front axle on the ride stability because the effect of braking-force unevenness on the rear axle proved to be very minor in preliminary tests. The measured variable angle of rotation of the vehicle about the vertical axis (yaw angle) was focused upon from the safety point of view in the weighing of numerous test results. The traction conditions between the braked rear wheels and roadway proved to be the main factor affecting the vehicle angle of rotation with unequal braking forces. It was found that the limits presently in effect for braking-force unevenness with rear wheels locked up are too high, while for braked but not locked rear wheels the limits in effect may be regarded as satisfactory. Retention of these limits, therefore, seems justifiable if based on rapidly increasing use of antilock rear-wheel equipment in motor vehicle construction in the near future. The capabilities of test equipment and methods used at present in mass testing of motor vehicles opposes a substantial decrease in allowable braking-force unevenness (on the order of 10%). Such a large reduction, however, will be necessary if a decisive improvement in truck stability is to be achieved even in vehicles without braking-force control systems.

by Hans Hirschberger; Hans Miedel; Wolfgang Ewald;
Eustache Bisimis
Contract 211
Publ: Deutsche Kraftfahrzeugforschung und
Strassenverkehrstechnik n212 (1971)
1971; 94p 21refs
Text also in German. Funded by the German Federal Minister for Transportation and Communications.
Availability: Techtran Corp., P.O. Box 729, Glen Burnie, Md.

The three major classifications of automobile maintenance are as follows: the mandatory replacement of parts due to friction and wear after the vehicle has traveled a certain set distance (maintenance service), the repair of mechanical troubles that occur unexpectedly and incapacitate the vehicle (repair service), and the repair of damage that has occurred accidentally as a result of such causes as traffic accidents (restoration service). In Japan, an amendment of the Road Vehicles Act in 1963 requires that each vehicle be inspected every six months with regard to all functions necessary to safe vehicle operation with repairs made when needed. In addition, the law requires that each vehicle owner, once a day before bringing his/her vehicle into operation, check the functions of the vehicle that are prescribed by the law as the minimum requirements for safe driving. The repair service category of maintenance work, which until the time of the amendment was the dominant category of maintenance work, has begun very gradually to decline. If it had not been for the highly qualified cooperation and aid of the auto repair shops (now numbering over 70,000), the motorization of Japan would by no means have been able to progress as successfully as it did. Today efforts are being made in Japan to raise the technical level of the service shops. Up to now it has been the practice for service shop repairmen to make decisions regarding inspection and repair diagnoses on the basis of feelings or hunches, and steps need to be taken to introduce a rational system of diagnosis. The concept of preventive maintenance is far from being sufficiently understood; drivers do not want to take the time to take a car to be serviced and even if a vehicle is taken to the shop for preventive maintenance, a correct diagnosis is often not made. Also, up until now the preventive maintenance employed by service shops involves checking a car while it is parked in a shop rather than under the actual conditions of operation. A solution to the preventive maintenance problem can be found in the Aichi Toyota Car Care Center, a car diagnostic center set up in 1967 whose aims are as follows: to make a diagnosis in one fifth the time of the normal service shop with great accuracy, to be economical (less than one third of the market price), to be highly accessible, to help prevent the dangers of traffic accidents caused by unsatisfactory car servicing, to help protect the atmosphere against harmful auto emissions, and to help cut fuel and service expenses as much as possible.

by Tenji Iki
 Publ: Wheel Extended v7 n2 p2-7 (Fall 1977)
 1977
 Availability: See publication

HS-022 199

A COMPARATIVE STUDY OF VARIOUS TYPES OF VEHICLE DETECTORS. FINAL REPORT

A comparison is made of the different types of highway-vehicle detectors and associated equipment based on information obtained from manufacturers and the technical literature. Practically all of the presence and motion detectors either being sold commercially or being actively researched at this time are discussed and include induction-loop, magnetic, radar, and acoustic vehicle detectors. Induction-loop detectors can be self-tuning, bridge-balance, and phase-shift. There are both

the different classes of detectors are presented, including principles of operation, detection parameters, installation requirements, and relative costs. Typical detector specifications are in the appendices. The relative prices (e.g. an induction-loop detector compared to a magnetometer) are approximately the same. The literature indicates that acoustic, pressure-sensitive and radar detectors are generally regarded as inferior to electromagnetic loop detectors, MGVD's, and magnetometers in terms of traffic-control applications. At the present time, induction-loop detectors are the most widely used of all the various types. However, the performance of magnetometers puts them in the same class with loop detectors; other magnetic detectors, in general, are just a little below this level. Recent research and tests have shown that the MGVD is also in the same class with loop detectors and also has some advantages over them. The MGVD is still under development by the Federal Hwy. Administration, but early results appear to forecast a bright future for MGVD's. The main advantage of the induction-loop detector has over the magnetometer is that a loop configuration can be chosen to cover a large detection zone, whereas the area-detection capability of a single magnetometer is restricted and many transducers are required for extended area coverage. Therefore, the cost of a magnetometer system can be greater than that for a comparable loop-detector system depending on the desired area of coverage. The final decision favoring either an induction-loop detector, MGVD, or a magnetometer for a particular application cannot be reached, however, without extensive information regarding the physical makeup of the desired detection zone, how the detector will be used, and economic considerations.

by Marcel Singleton; John E. Ward
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 Cambridge, Mass. 02139
 Contract DOT-TSC-849
 Rept. No. DOT-TSC-OST-77-9; DOT-TSC-OST-77-4; 1977; 6
 7refs
 Rept. for Jun 1975-Sep 1976.
 Availability: NTIS

HS-022 200

SHOULDER BELT USE RELATED TO SEX, AGE, MOVING SPEED AND WEATHER CONDITIONS

Shoulderbelt usage related to the driver's sex and age, the vehicle moving speed, and meteorological conditions was observed in eastern Ontario, Canada. Observations were made on 64 consecutive or alternate days along a highway and at downtown survey site, and data were collected on a total of 29,685 drivers during periods in which a new seatbelt law was respectively announced, came into effect, was eventually enforced, and in which the speed limit was 70 mph or 60 mph. When seatbelt use was voluntary, more drivers wore seatbelts at both sites when pavements were slippery and when it was snowing. However, when seatbelt use was imposed by law, the effect of the weather was considerably less. In the downtown area, when seatbelt use was mandatory, the shoulderbelt utilization rate for male and female drivers was found to be lower under adverse pavement conditions and with precipitation than when conditions were good. Prior to the reduction in the posted speed limit on the highway from 70 mph to 60 mph, adverse pavement and weather conditions affected mean moving speeds considerably more than after

wards. Shoulderbelt use was significantly more frequent in female than in male drivers passing the downtown survey site. This was also the case after the seatbelt law had come into effect and its enforcement had been announced. The highway data, on the other hand, showed no such difference between the sexes. Shoulderbelt wearing was also found to be significantly more frequent in drivers of an estimated age under 25 than among older drivers, while age effects were not considered at the highway observation site. At the downtown location younger drivers appeared to respond relatively more to the announcement of the seatbelt law, while older drivers reacted more to its enforcement. Sex differences were not seen to occur. On the highway males appeared to respond relatively more than females to the fact that the law was in effect, while the effect of the enforcement phase seemed to show no differences between the sexes (age differences not considered). However, the overall increases in shoulderbelt wearing frequencies from the voluntary to the enforcement period were approximately the same in both sexes and in both age groups. Average moving speeds of vehicles with female drivers were found to be consistently lower than in male drivers. The reduction in the highway speed limit produced an actual average speed reduction of about 7 mph and a significant reduction in the speed variability between cars. In general, it was found that speed limits have a strong homogenizing effect upon moving speeds, while adverse pavement and weather conditions produce greater heterogeneity in speeds. The association between shoulderbelt use and moving speed was found to be marginal in size and of questionable significance.

by G. J. S. Wilde
Queen's Univ., Dept. of Psychology, Kingston, Ont., Canada
Rept. No. TP-1093; CR-7709; 1977; 28p 16refs
Sponsored by Ministry of Transportation and
Communications, Toronto, Ont., and Ministry of Transport,
Rd. and Motor Vehicle Traffic Safety, Ottawa, Ont., Canada.
Includes French summary.
Availability: Ministry of Transport, Rd. and Motor Vehicle
Traffic Safety, Ottawa, Ont., Canada

HS-022 201

RATE OF HEAT RELEASE IN DIESEL ENGINES. FINAL REPORT

The concept of heat release in diesel engines is compared with reaction rates in gasoline engines as a means of describing combustion. The intimate relationships among heat release, cylinder pressure development, and cylinder pressure spectra are illustrated. There is a strong relationship between the initial peak rate of heat release and the level of combustion-induced noise, the noise increasing as the peak increases. Since the maximum rate of pressure rise is also related to the initial peak heat release rate, there is a general relationship between it and the level of combustion noise. A combustion model for the prediction of heat release and combustion noise, based primarily on physical aspects of diesel combustion system design, is put forward. The model is a two-zone model based on modified single droplet and simplified jet theories. This model indicates that fuel droplet size and the temperature of the cylinder contents are of prime importance in determining cylinder pressure noise excitation. The relationship between cylinder pressure spectra and combustion-induced engine noise is described and used to show how the combustion model can predict combustion-induced noise at the design stage. For a given engine noise level due to combustion, there is a maximum rate of pressure rise associated with a particular bore

size and engine speed which reduces rapidly as the bore size increases. A simplified procedure based on the results of this modeling is put forward to predict combustion-induced noise as a function of rate of pressure rise, speed and bore and is applied to a Standard Engine Structure. As an approximation, the prediction formulae are also given in terms of initial peak rate of heat release, engine speed, and bore. Design parameters which are predicted as the main controlling features of combustion, from a noise point of view, are the average fuel spray droplet size and the temperature of the cylinder contents during the delay period. Use of rapid rates of fuel injection is detrimental to the design of low-noise diesel engines.

by David Anderton
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Contract DOT-TSC-1101
Rept. No. DOT-TSC-OST-77-56; 1977; 147p 53refs
Rept. for May-Oct 1976.
Availability: NTIS

HS-022 202

A HUMAN FACTORS ASSESSMENT OF DECREASED TRAFFIC SIGNAL BRIGHTNESS

Decreased nighttime traffic signal lamp brightness is discussed in terms of human visibility requirements. Suggestions have been made to decrease night traffic signal lamp intensity as a fuel conservation measure; there has not, however, been a detailed assessment of the operational implications of lower traffic signal brightness. Human factors considerations involved in error-free perception of traffic signal indications include visual capabilities such as age, anomalous color perception, and factors such as color of traffic signal, optimum luminance, contrast, and glare. Since signal perception is dependent on intensity and contrast ratio, night visibility of signals is often superior to that under high daytime brightness levels. This superior night visibility is desirable for the following reasons: the possibility of extraneous glare sources (e.g. misaimed headlights, outdoor advertising, luminaires); the lack of other environmental cues; the potentially adverse effects of rain, snow, and fog; and the greater probability of fatigue and other factors impairing driver performance. From a safety standpoint, it is only when signal intensity exceeds glare thresholds that a tradeoff is necessary between visibility and intensity. Data show that the 8-inch (200 mm) signal intensities do not exceed the glare threshold and that the day intensity of this signal is required at night for many urban background luminances; therefore, they should not be dimmed. There are situations where the 12-inch (300 mm) signal, particularly the narrow beam configuration, exceeds both intensity needs and glare thresholds; in these instances, dimming is justified. However, these cases represent a small portion of the traffic signals used in the U.S. and their impact on overall energy conservation will be minimal.

by Harold Lunenfeld
Publ: Public Roads v41 n3 p19-25 (Dec 1977)
1977; 17refs
Availability: See publication

HS-022 203

THE ESCALATING WAR ON REDUCED VISIBILITY

The term "reduced visibility" has traditionally been associated with fog, and fog continues to be a major contributor to highway problems. Other natural and manmade factors which also cause serious restrictions are snowstorms, dust storms, burning sugar cane, smoke from roadside fires, and industrial effluents. The most publicized consequence of reduced visibility on the highway is the multiple-vehicle chain reaction accident. Degraded visual ability in such conditions as fog or smoke is due primarily to the presence of one or more of the following three factors: lack of contrast, glare, and impaired distance judgment. Methods of eliminating the cause of the problem include fog dispersal and dissipation, but such methods have little utility in the highway environment. Examples of approaches toward minimizing the reduced visibility hazard include fixed highway lighting, traffic platoons or convoys to escort vehicles through fog, radio advisories, lowered speed limits, road closure, and driver education. All of these remedial measures have limitations which weaken their effectiveness as overall solutions to the reduced visibility problem. In an attempt to overcome many of these limitations, various types of reduced visibility guidance (RVG) systems have been developed in recent years. Although diverse in their sophistication, application, and cost, such systems have at least two common characteristics: a detector to detect the presence of a problem, and a subsystem to advise the motorist of appropriate action. The results to date with RVG systems, however, have been far from encouraging. The following are some of the problems with these systems: difficulties with the visibility detectors themselves (e.g. unable to detect highly localized fog, subject to vandalism, need frequent calibration), the signing of a changeable message sign (e.g. gusty winds, use caution), too small, and not providing enough information, and the "Cry Wolf" effect (the degree of confidence a motorist has in that system).

by Jerry A. Wachtel
 Publ: Public Roads v41 n3 p112-8 (Dec 1977)
 1977; 9refs
 Pt. 1 of 2
 Availability: See publication

HS-022 204

THE NEW "SIGNS" OF THE TIMES [HIGHWAY SYMBOL SIGNS]

The trend in the U.S. is toward highway signs using pictures and symbols, rather than words. Tests have proven that motorists react and take action more quickly when they see a symbol than when they read words. The Manual of Uniform Traffic Control Devices (MUTCD), published in 1971 and updated annually, is the end result of many different agency studies. The MUTCD is the law and must be adhered to by state highway agencies in order to receive Federal highway funds. Any newly developed sign adopted by the MUTCD must be accompanied by an educational plaque, in English, explaining the meaning of the sign which must appear directly below the sign on the same standard for a period of three to five years. One of the first European-type signs for traffic control adopted in the U.S. is the "Do Not Enter" sign utilizing a large red circular sign with a horizontal white slash. Other symbol signs already adopted and in use include "Signal Ahead," "No Right Turn," "No U Turn," and "No Trucks" signs. Many states favor the change-over to symbol signs as mandatory

rather than optional. Presently, states have an option to change immediately or wait the five to six years of compliance time. All states agree with the Federal Hwy. Administration that education of the driving public is an important aspect concerning the success of symbol signs. It is certain that the European system will not be adopted in its entirety, but the best of that system and the present American system seems to be the coming standard for U.S. roadways.

by Paul Mitchell, Jr.
 Publ: California Highway Patrolman v41 n18 p8-10, 32-3 (Dec 1977)
 1977
 Availability: See publication

HS-022 205

1970 ANALYSIS OF ACCIDENT REPORTS INVOLVING FIRE [MOTOR CARRIERS]

This statistical summary report contains data extracted from 744 accident reports which indicated that fire was involved in the accident; the reports were submitted to the Bureau of Motor Carrier Safety (BMCS) by motor carriers with operating authority from the Interstate Commerce Commission, and carriers of exempt commodities subject to BMCS safety regulations for 1970. The first part of this report contains 11 tables relating to 729 property carrier accidents which resulted in 132 fatalities, 309 injuries, and \$7,831,728 property damage. The second part of the report contains 18 tables relating to 15 passenger carrier accidents which resulted in two fatalities, 18 injuries, and \$122,350 property damage. The tables contain data relating to the months in which accidents occurred, types of units involved, types of accidents, methods of extinguishing fires, locations and causes of fires, mechanical defects found in vehicles, year in which vehicles were manufactured, types of fuel tanks involved, and commodity classifications of property carriers. Property carrier accidents involving moving vehicles have been separated from those involving stopped vehicles; this was not done in the passenger carrier tables since all 1970 bus accidents involving fire were moving vehicle accidents.

Federal Hwy. Administration, Bureau of Motor Carrier Safety,
 Washington, D.C. 20590
 1972; 20p
 Availability: Corporate author

HS-022 206

SUMMARY OF MOTOR VEHICLE INSPECTION REQUIREMENTS IN CANADA

Four provinces or territories require the periodic (annual) inspection of motor vehicles: New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island. Six provinces or territories have limited inspections systems which require the inspection of certain vehicles, mainly school buses: Alberta and Saskatchewan, school buses; British Columbia, all vehicles in certain populous counties; Manitoba, certain vehicles selected by computer; Ontario, school buses, certain used vehicles, and newly registered vehicles, Quebec, school buses and taxis. Ten provinces or territories allow a police officer to stop a vehicle to inspect its equipment: Alberta, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Quebec, Saskatchewan, Yukon. Northwest Territory has no inspection requirement. Three provinces or territories have a

provincially owned and operated inspection system: British Columbia, Manitoba, Quebec. Six provinces or territories have a privately owned and operated system, or a provincial appointed system: Alberta, New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, Saskatchewan. Ontario has a combination of both types. The inspection fee varies from no charge to \$5 for most passenger vehicles. In the second part of the report, the inspection requirements are summarized under each individual province or territory.

Motor Vehicle Manufacturers Assoc. of the U.S., Inc., State Relations Dept.
1977; 36p
Availability: Corporate author

HS-022 207

SUMMARY OF STATE MOTOR VEHICLE INSPECTION LAWS AND REGULATIONS

Twenty-eight states and the District of Columbia have laws requiring periodic motor vehicle inspection (P.M.V.I.). Eight states have some form of random spot inspection. Of these, California, Michigan, and Minnesota require inspection of school buses. Five states presently have limited inspection laws, with Arizona and Connecticut requiring school bus inspection. Nine states have no state motor vehicle inspection laws. Delaware, District of Columbia, and New Jersey have state-owned inspection systems. Most of the other states have a city, county, or state appointed system. Seven states with P.M.V.I. require two inspections a year. The others require annual inspection, except Hawaii, which requires passenger cars ten years old and over and all other vehicles to be inspected twice a year. Delaware is the only state with free inspection. The fee varies in other states from \$1 in Rhode Island to \$8 in Iowa. In some states the fee is determined by the county or the inspection station. Brakes, rear reflectors, and tires are the most commonly inspected items of equipment, with exhaust systems, windshield wipers, horns, headlights, turn signals, and steering being the next most frequently inspected items. A tabulation is presented of equipment items inspected by each state. In the last part of the report, motor vehicle inspection information is summarized by state.

Motor Vehicle Manufacturers Assoc. of the U.S., Inc., State Relations Dept.
1977; 165p
Availability: Corporate author

HS-022 208

WHAT KINDS OF PEOPLE DO NOT USE SEAT BELTS?

In a Community Mental Health Epidemiology study conducted in Washington County, Md., Dec 1971-Jul 1974, interviews were conducted with randomly selected adults in a weekly systematic sampling of households to determine seatbelt use. In a subsequent re-interview of 1009 respondents who had family cars with seat belts, nearly 47% said they did not use them. Nonuse of seat belts was significantly higher among females and among persons with less than high school education or low income. Nonuse of seat belts was also higher among those who felt that their station in life as measured by the Cantril ladder was unsatisfactory, who felt powerless to change at least some aspects of their lives, and who were infrequent church attenders. Significant associations were also

found with infrequency of two other preventive health behaviors: dental checkups and Pap tests. Among young adults the tendency seemed to be for marriage to increase the nonuse of seat belts among females but to decrease nonuse among males.

by Knud J. Helsing; George W. Comstock
Publ: American Journal of Public Health v67 n11 p1043-50
(Nov 1977)
1977; 29refs
Availability: See publication

HS-022 209

ALCOHOLS. A TECHNICAL ASSESSMENT OF THEIR APPLICATION AS FUELS

If synthetic fuels were to become cheaper than petroleum, alcohols would compete with hydrocarbon liquids from shale or coal. Should alcohol become competitive, its best use would be as land-based gas turbine fuel, where clean-burning and low nitrogen oxide formation would be advantageous. In automobiles, the use of straight alcohols in modified engines would be preferable to alcohol-gasoline blends. Energy contents of alcohols are substantially lower than those of hydrocarbons, and alcohols have a low solubility in petroleum fuels except aromatic gasolines. Alcohol-gasoline blends produce high vapor pressures. Alcohols also differ from petroleum fuels in corrosivity toward metals, compatibility with plastics and rubbers, toxicological properties, and fire hazards. Alcohols have wider flammability limits and their vapors are explosive at ambient temperatures. Methanol is toxic, whether ingested, inhaled, or absorbed through the skin. Alcohols cannot be interchanged with gasoline in conventional vehicles without costly modifications of vehicles and distribution systems. Thermal efficiency is potentially better with alcohols, but fuel economy is reduced due to lower energy content, exhaust emissions of hydrocarbon and carbon monoxide would be essentially the same, cold starting would be difficult, and durability would be impaired due to chemical reaction of alcohol with fuel system materials. Alcohol-gasoline blends offer thermal efficiency, offset by reduced energy content, and essentially the same exhaust emissions as gasoline. The chief advantage of alcohol-gasoline mixtures would be reduction of knock and after-running. The chief disadvantages would be the risk of phase separation at low temperatures or with water contamination, corrosion or deterioration of fuel system parts, and deterioration of vehicle driveability due to leaner burning and high vapor lock tendency. To overcome these difficulties, fuel distribution systems would need to be modified to exclude water, fuel system materials would have to be replaced, and engine fuel metering systems would need to be recalibrated. Use of alcohol-gasoline blends is the least attractive alternative, due to the loss of the potential advantages of straight alcohols.

American Petroleum Inst. Com. on Mobile Source Emissions,
2101 L St., N.W., Washington, D.C. 20037
Rept. No. Pub-4261; 1976; 31p 88refs
Availability: Corporate author

HS-022 210

TROUBLE IN THE AUTO REPAIR SHOP

Tools are the greatest safety hazard in the auto repair shop due to improper use and lack of machine safeguards. Tripping and falling hazards, exposure to exhaust gases, parts cleaner

flating, mounting, or dismounting tires on split rims. The grinding machine is a potential hazard, requiring tool rests and eye protection. Rotating pulleys and belts should be guarded. Slip and fall hazards can be reduced by keeping the shop floor free from spilled grease and oil. Auto mechanics are commonly exposed to asbestos fibers from brake components and clutches. Asbestos is hazardous when inhaled and has been found to be carcinogenic. Lead absorption is another potential hazard, by inhalation, ingestion, and skin absorption of leaded gas. Catalyst-equipped vehicles emit more sulfuric acid and hydrogen sulfide vapors than noncatalytic vehicles. Nitrogen dioxide and carbon monoxide from exhaust fumes should be dispelled by ventilation. Tool vibration can cause numbing of the hands. Hazards from ozone, nitrogen oxide, and even phosgene can result from welding fumes. Health and safety hazards are being challenged by the unions, the Federal government, insurance companies, the industry, and the workers themselves with some assistance from the press. What is most needed is conscientious training for both shop managers and mechanics on the nature, cause, and prevention of worksite injury and illness. Safety training is required by the General Motors School of Product Services.

by Carol Morgan

Publ: Driver v11 n7 p22-7 (Dec 1977)

1977

Reprinted from Job Safety and Health.

Availability: See publication

HS-022 211

OBSERVATIONS OF FUEL SAVINGS DUE TO THE INTRODUCTION OF RIGHT-TURN-ON-RED

The effect of introducing right-turn-on-red (RTOR) legislation in Michigan was investigated by means of a before-and-after study in actual traffic. An instrumented car was driven repeatedly around a two block by four block area in downtown Detroit during the two-week periods immediately preceding and following the change in the law. RTOR was prohibited on one corner of the test run. Purposes of the investigation included determination of the effect of RTOR on fuel consumption for one particular urban situation, determination whether observed data fit a linear relation between fuel consumption and trip time, and measurement of the effect of peak versus off-peak traffic on changes in fuel consumption and travel time resulting from RTOR. The average transit time, stopped delay, and fuel consumption all show reductions due to the RTOR policy in both peak and off-peak traffic. The numerical results obtained in this study are useful in identifying aspects of urban traffic that are likely to influence potential fuel savings from the RTOR policy, such as coordinated signal systems and heavy cross traffic. Pedestrian traffic was found to be as significant as vehicular traffic in delaying right turns on red. The time savings observed at intersections with no turns and the overall reduction in running time indicate that, in assessing benefits from RTOR, it is not sufficient to consider

Human Engineering and Safety Factors are published Oct 1977; 9refs
Availability: See publication

HS-022 212

RUBBER MIRRORS

By a single mechanism for changing air pressure, a rubber mirror's shape can be altered to produce convex or concave distortions, thus enlarging or reducing the reflected image. Rubber can be prepared with an optically smooth surface which can be gilded by vacuum deposit for increased reflectivity. Satisfactory rubber mirrors have been produced in sizes from 10 mm to 300 mm in diameter. In laboratory trials, a particular natural rubber outperformed all others in long term clarity and fatigue resistance. Mirrors made from natural rubber were found to be free of tarnish or fatigue cracks after 200,000 operation cycles over five months. Rearview mirrors in automobiles are a possible application of this device, as are bathroom mirrors and telescope or mirror lenses. Rubber mirrors could be used as variable focus heat reflectors or as variable focus parabolic radar bowls. The haze produced on rubber mirrors by "bloom" could provide a sensitive test for different rubber compounds.

by A. D. Roberts

Publ: Rubber Developments v30 n3 p60-2 (1977)

1977; 2refs

Availability: See publication

HS-022 213

HEAD MOVEMENTS OF DRIVERS. [2] COMPENSATORY HEAD MOVEMENTS DUE TO RESTRICTION IN THE VISUAL FIELD

In this second study on head movements as an indicator of attention distribution of drivers in traffic situations, registrations of head movements were made at urban road crossings to study the effect of restrictions of the visual field on the scanning behavior of drivers. Four male subjects, aged 25-32 years, drove in real traffic wearing spectacles that restricted their visual fields of fixations. Three different levels of restriction of the visual field of fixations were chosen, corresponding to a maximum binocular visual field of 80°, 65°, and 50° respectively. Maximum amplitude of horizontal head movements was used as the main dependent variable. The subjects were found to change their systematic scanning behavior due to restrictions in their visual fields, by making correspondingly longer horizontal head movements. The subjects did not drive significantly slower, neither did they express any feelings of insecurity when driving with a restricted visual field. It is thought unlikely that thick frames of glasses should impair the effectiveness of the information selection task in driving. However, if a driver uses an improper strategy of search or a target appears in a completely unexpected position, a

HS-022 214

A STUDY TO IDENTIFY HYDROPLANING ACCIDENTS. FINAL REPORT

Studded tire wear on road pavements led to a study of the possible effects of such damage on the proliferation of hydroplaning accidents. The objectives of the study were to identify such accidents and their locations, to examine road, vehicles, and weather conditions associated with hydroplaning, and to try to prevent recurrence of identified hydroplaning accidents. Library research and review of existing accident reports led to the design of a supplementary accident report which was filled out by all police agencies for wet-pavement accidents on the state trunkline system and attached to the regular accident report. With approximately 1400 bilevel reports obtained during a six-month period (13% of the known total of wet-pavement accidents), it was only possible to determine with certainty which accidents could not have been caused by hydroplaning. The rest indicated possibility of having involved hydroplaning. This latter group was less than 5% of the sample of wet pavement accident reports received. An analysis of the reported conditions resulted in a list of frequency of parameters associated with possible hydroplaning. Sixty-eight locations were selected for field investigations to determine if roadway improvements might be warranted. Although impossible of absolute identification, true hydroplaning accidents on the highways are rare, and certainly below 5% of wet-pavement accidents. It is recommended that a greater effort be made to educate the public as to the degree of deterioration of tire capabilities on wet pavements under high speeds. Opportunities to apply the results of new research and development should also be explored, including acquisition and application of new and unconventional materials such as synthetic aggregates, permeable bituminous wearing courses, novel concrete mixes, or modulated prefabricated surfacing materials.

by Nejad Enustun
Michigan Dept. of State Highways and Transportation, P.O.
Box 30050, Lansing, Mich. 48909
Rept. No. TSD-330-77; 1976; 52p 56refs
Availability: Corporate author

HS-022 215

VISIBILITY IN BLOWING SNOW AND APPLICATIONS IN TRAFFIC OPERATIONS

Wind and visibility data continuously transmitted from two monitoring stations on I-80 between Laramie and Rawlins, Wyo. are analyzed real-time by a computer. Summaries of conditions are printed out hourly, with recommended regulations and warnings when minimum standards are exceeded. Required speed limits are determined by equating "stopping sight distance" to the hourly average minimum visibility, and solving for vehicle speed. The visual range monitor uses a photoelectric particle counter to measure size and frequency

of index snow conditions, predict visibilities based on wind forecasts, and detect snowfall. This information is used for road closure or opening decisions, and to estimate time required for visibility to reach the prescribed standard for opening a road. Computerized analysis of weather data is essential for timely and objective traffic operations decisions, and the relationship between wind and visibility in blowing snow can provide the basis for standards that are technically sound and unambiguous.

by R. D. Tabler
Department of Agriculture, Forest Service, Laramie, Wyo.
1977; 12p 6refs
Presented at Symposium on Driver Visibility Under Varying Adverse Weather Conditions, Portland, Oreg., 16-18 Aug 1977. Supported in part by Wyoming Hwy. Dept.
Availability: Rocky Mountain Forest and Range Experiment Station, 222 S. 22nd St., Laramie, Wyo. 82070

HS-022 216

SPEED ESTIMATES IN VEHICLE ROLLOVERS

Analytical relationships that are used by accident investigators for estimation of vehicle speeds in rollover accidents are reviewed and tested against corresponding results obtained with a three-dimensional computer simulation of vehicle dynamics. On the basis of results of the reviews and result comparisons, the following revised relationships are defined for improved accuracy. Rollover can occur as a result of driver control inputs on a uniform surface with a friction coefficient that is considerably lower than the "required" value determined by a simple static analysis of the given vehicle. In simple rollovers produced by curb or other obstacle contacts, the minimum lateral speed of the vehicle can be approximated through application of the principle of conservation of angular momentum about the contact point on the obstacle. A widely used approximation technique that is based on conservation of energy does not yield valid results. In simple rollovers produced by lateral sliding on a uniform, high-friction surface (e.g. an unpaved surface), a reasonable approximation of the minimum lateral speed can be obtained through the use of work-energy relationships. In a lateral "flip" (i.e. a rollover in which the vehicle travels through the air for a significant distance), approximation of the minimum lateral speed of the vehicle on the basis of a trajectory analysis should make use of the optimum launch angle (i.e. the angle which will yield the maximum horizontal distance for a given speed) corresponding to the elevation change between the take-off and landing points. The routine use of a 45° launch angle can introduce significant analytical errors. A brief, exploratory investigation of the rollover dynamics of a vehicle with a simple swing-axle rear suspension was made. Computer simulation of three-dimensional vehicle dynamics can serve as an effective means of investigating parameter sensitivities in rollovers, reconstructing complicated accidents, and testing simple approximation techniques used in accident reconstructions.

by Raymond R. McHenry
Calspan Corp., Transportation Res. Dept., Buffalo, N.Y. 14221
Contract-87-050
Rept. No. Calspan-ZQ-5639-V-1; 1976; 35p 13refs
Availability: Corporate author

HS-022 217

FEASIBILITY OF INVESTIGATING THE MECHANISMS OF AORTIC TRAUMA USING HIGH-SPEED CINERADIOGRAPHY--A PILOT STUDY. FINAL REPORT

A pilot study was performed to evaluate use of the Hwy. Safety Res. Inst. high-speed cineradiographic system for study of aortic trauma mechanisms. The thoraxes of anesthetized New Zealand white rabbits were impacted by a dropped accelerometer-instrumented, 1.5 kg mass from a height of 2.44 meters. Velocity and force data were obtained from the instrumented impacting mass. High-speed cineradiographs at approximately 1000 frames per second showed thoracic skeletal deformation and heart, diaphragm, and liver displacements. No radiopaque contrast medium was used in this preliminary investigation. Post-impact autopsy revealed rib fracture, localized hemorrhaging, and aortic transection. On the basis of film obtained, this method has potential for the study of internal organ injury mechanisms.

by Roger H. Culver; Max Bender; Richard L. Stalnaker; John W. Melvin; David C. Viano
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48109; General Motors Res. Labs., 12 Mile and Mound Roads, Warren, Mich. 48090
Grant RL-147461
Rept. No. UM-HSRI-77-53; 1977; 41p 6refs
Rept. for 15 May-31 Aug 1977.
Availability: Corporate author

HS-022 218

FEMUR IMPACT STUDY. FINAL REPORT

Data were generated to better study the mechanism of femur fracture. Thirteen human knee impacts were conducted with and without flesh on the femur. Strain gages and pelvic accelerometers were used in most tests. High speed movies were taken of all tests to give an overview of the femur kinematics. The test procedures generated good test data for studying the failure mechanisms of the femur under axial loading. The flesh could be removed from the femur while still maintaining the knee joint complex in a normal state. The strain gage mounting techniques resulted in good bonding of the gages to the bone both during and subsequent to the tests. The overhead camera frame rate of 1000 fps was found to be too low for this type of test.

by Richard L. Stalnaker; Guy S. Nusholtz; John W. Melvin
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48109
Rept. No. UM-HSRI-77-25; 1977; 165p
Rept. for 1 Feb-30 Apr 1977.
Availability: Corporate author

HS-022 219

WORLD MOTOR VEHICLE DATA. 1977 ED.

A statistical compilation of international motor vehicle data (production, exports, imports, registrations, and sales) through 1976 is presented. World data are tabulated first; statistical tables for geographical areas/countries are then given as follows: Africa (Morocco, South Africa, countries importing to Africa), Asia (India, Japan, Korea), Europe (France, West Germany, Italy, Sweden, United Kingdom, Belgium, Ireland, Nether-

lands, Nordic Countries, Denmark, Portugal, Spain, Switzerland, European Community, Common Market), Eastern Europe (Czechoslovakia, Poland, Russia, Yugoslavia, Eastern Bloc Countries, Other Eastern Countries), Oceania (Australia, New Zealand), Western Hemisphere (Argentina, Brazil, Chile, Ecuador, Mexico, Peru, Venezuela, LAFTA (Latin American Free Trade Assoc.), Canada, U.S.A.). Production totals are given by manufacturer as well as by country. Since different data sources were used from year to year, there are occasional differences in the number reported for various classes of vehicles for some countries. This is the result of the lack of uniformity of definitions for certain vehicles; in such cases, car, truck and bus data vary from one source to another and, accordingly, in the year-to-year data reported. Although efforts were made to segregate vehicle assembly data from production data, the world totals for production may include some duplication since it is not possible for all countries to identify assemblies from production. The data in this compilation were supplied by foreign government agencies, trade associations, private services, and the press. The basis on which the data are reported varies. For example, vehicle output may be measured in terms of production, shipments, or factory sales. New vehicles sold may be measured in terms of retail sales or new registrations. Imports and exports are subject to problems of compilation and definition. As a result, data accuracies vary and international comparisons are affected by these discrepancies.

Motor Vehicle Manufacturers Assoc. of the United States, Inc., Communications Div.
1977; 206p
Availability: Motor Vehicle Manufacturers Assoc. of the United States, Inc., 300 New Center Bldg., Detroit, Mich. 48202 \$20.00

HS-022 220

DRINKING AND ACCIDENTS. STUDY OF ALCOHOL LEVELS IN 328 FATAL HIGHWAY ACCIDENTS (ALCOOLEMIE ET ACCIDENTS. ETUDE DE L'ALCOOLEMIE DANS 328 ACCIDENTS MORTELS DE LA CIRCULATION)

The alcohol levels of people involved in 328 fatal traffic accidents involving 379 deaths in a region west of Paris, France during 1970-1975 were analyzed. For the 197 cases where the alcohol level of the guilty party was determined, the level exceeded the legal limit in 38% of the cases (compared to 34% for the period 1970-1973 (45/133) and 47% for 1974-1975 (30/64). Since the accidents caused by drivers under the influence of alcohol were more severe than accidents caused by other drivers, they were responsible for 41% of the deaths while they represented 38% of the fatal accidents. In accidents where all of the persons involved were examined for alcohol levels, the percentage of levels of greater than or equal to 0.80 g/l in at least one of the persons involved increased to 46%. The percentage of alcohol levels of greater than or equal to 0.80 g/l among car drivers involved in fatal accidents but not responsible for them was found to be higher than the percentage observed among drivers not involved in accidents. Elevated alcohol rates were observed very frequently in car-pedestrian accidents (most often caused by the pedestrian) and

(n.d.); 175p 6refs
Sponsored by Interministeriel Com. for Hwy. Safety and the High Com. for Alcoholism Studies and Information (Le Comité Interministeriel la Sécurité Routière et le Haut Comité d'Etudes et d'Information sur l'Alcoolisme).
Availability: Techtran Corp., P.O. Box 729, Glen Burnie, Md.

HS-022 231

OPTIMIZATION OF A FLAME IONIZATION DETECTOR FOR DETERMINATION OF HYDROCARBON IN DILUTED AUTOMOTIVE EXHAUSTS

The effects of burner flow parameters, fuel type, and fuel composition on the uniformity of relative response of a flame ionization detector (FID) hydrocarbon analyzer were experimentally investigated, and means have been found to improve correlation between analyzers and to optimize relative response characteristics. The following steps, in decreasing order of importance, are recommended for optimization on the Beckman Model 400 FID for analysis of dilute exhaust sample bags from the Federal Vehicle Emission Test: maintain sample flow rate at a minimum (suggested flow rate of 5 cc/min), use H₂ (hydrogen)/He (helium mixed fuel suggested composition of 40% H₂), use high fuel flow rate to the FID burner (suggested flow rate of 100-120 cc/min), and use high air flow rate to the FID burner (suggested flow rate of four times the fuel flow rate). No matter what flow parameters are used, it is important to set the burner flow rates of each instrument to the same value to obtain good correlation between instruments. Although the above steps are recommended specifically for analyzers being used for analysis of dilute exhaust sample bags, they can be applied to FID's in other applications providing relative response optimization is considered in light of the expected oxygen level of the sample, the response time needed, and the sensitivity required.

by Glenn D. Reschke
General Motors Proving Ground, Vehicle Emission Lab.
Rept. No. SAE-770141; 1977; 24p 6refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 232

CASE DESCRIPTIONS OF LAP-SHOULDER BELTED OCCUPANTS IN CAR CRASHES

From detailed field crash investigations, 24 case descriptions are presented of accidents in which at least one car occupant was wearing a lap-shoulder belt. These crashes are those (mostly frontal type) in which it would be expected that the unrestrained occupant would incur injury levels in the severe or greater range. Detailed injury information is presented along with photographs of car damage, occupant contact areas, and where possible, the estimated impact speeds. In almost all of the cases presented for the frontal-type of crash, the occupants were restrained from significant contact with the forward structures of the automobile or occupant contact was completely eliminated. The injuries sustained by the belted oc-

cupants: Michael J. Murphy; Donald F. Huelke; Harold W. Sherman
University of Michigan Medical School
Rept. No. SAE-770151; 1977; 18p 10refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 233

SAFETY BELT USE LAWS IN EUROPE--A POSITIVE INITIATIVE FOR SAVING LIVES

A preliminary report is presented on the implementation and effectiveness of mandatory seatbelt use laws in seven representative European countries (Sweden, Denmark, Switzerland, West Germany, Finland, Norway, and France). Results show that mandatory safetybelt use laws are highly effective when they have been preceded by a public education program and when they have been supported by a civil fine or penalty and reinforced by sustained, conscientious police enforcement. In every country surveyed, the government provided the leadership, funding, and impetus that led to the enactment of the legislation. Belt use legislation was not considered to be a radical or unthinkable proposition, as sometimes viewed by critics in the U.S. It was considered to be part of an overall package of auto safety measures which logically should be utilized. The package also includes reduced speed limits and increased controls over drunken drivers. In almost every country, the insurance industry supported the government in educating the public about the benefits of the law. The auto industry in Sweden and West Germany gave limited support to the government in promoting the law; the industry was neutral in other countries where autos are manufactured. Most experts interviewed stressed the importance of comfort, convenience, and ease of wearing safety belts as essential to a high belt use rate. Even in countries with no penalty or fine, seatbelt use laws have increased usage two to four times. Most of the countries do not as yet have data documenting the saving in lives and serious injuries to support their claims of achievement. The increase in seatbelt usage to rates of 78.9%-95% in those countries where the laws were properly explained to the people and are effectively enforced provides substantial evidence that the enactment of mandatory seatbelt use laws will prove to have been a significant positive initiative for saving lives.

by H. George Johannessen; Charles H. Pulley
Hamill Mfg. Co.; American Safety Belt Council
Rept. No. SAE-770152; 1977; 11p 9refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 234

THE CANADIAN APPROACH TO THE SEAT BELT PROBLEM

The Canadian seatbelt program began by obtaining an overview of the public's attitudes towards seat belts and the extent of their knowledge about them. A subsequent nationwide in-

formation campaign (educational TV, radio, newspapers), using materials developed and tested for effectiveness by the Rd. Safety Branch, attempted to reduce a knowledge deficit revealed by the attitude surveys. Steps were also taken to obtain accurate estimates of the extent of both present seatbelt use and support of mandatory use. Most Canadians, it was indicated, are in favor of mandatory seat belt use. Supplementing this information, an analysis was carried out on existing data to arrive at estimates of the effectiveness of seat belts under certain levels of use.

by Ruth M. Heron
Queen's Univ., Dept. of Psychology, Canada
Rept. No. SAE-770153; 1977; 8p 7refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 235

CIVIL AIRCRAFT RESTRAINT SYSTEMS: STATE-OF-THE-ART EVALUATION OF STANDARDS, EXPERIMENTAL DATA, AND ACCIDENT EXPERIENCE

A state-of-the-art evaluation of standards, experimental data, and accident experience related to civil aircraft restraint systems is presented. Current estimates of the number of fatalities which the use of upper torso restraint systems could prevent annually in survivable accidents range from 33% to 94%. Current FAA (Federal Aviation Administration) belt strength standards for all categories of civil aircraft are 1500 lbs in tension load and 1.9 times rated strength (loop load strength of 2850 lbs.) in a static test. The 1950 NAS (National Aircraft Standard Specification), FAA TSO 22f, belt strength requirements remain the same in 1977 as 25 years earlier, when found inadequate in NACA (National Advisory Com. for Aeronautics) tests, and despite Australian findings of 18% failure in serious accidents. At present there are no FAA standards or tests required for upper torso restraint or for inertia reels; NAS 802 and TSO-C22f relate only to lap belts. There is no requirement at present for upper torso restraint protection for all civil aircraft occupants, even in newly certified aircraft. Although strongly recommended in the FAA crashworthiness guide, and required by Federal standards for automotive vehicles, there is no requirement as yet for dynamic test of civil aircraft restraint systems. No consideration has been given in present standards to infant and child occupant protection. The ultimate inertia force requirements of Parts 23, 25, 27, and 29.561 (Code of Federal Regulations (14 CFR 1.1), Aeronautics and Space) are totally inconsistent and outdated for realistic occupant restraint protection; consideration needs to be given to "moderate to severe survivable accidents" rather than the present undefined "minor crash landing" design criteria. Civil aircraft restraint standards are below comparable requirements of other Federal standards and far below the state-of-the-art technology. It is within the state-of-the-art technology to provide protection to occupants of small airplanes (Part 23), air transports (Part 25), and normal (Part 27) and air transport helicopters (Part 29) far above the minimum standards now provided in such aircraft.

by Richard G. Snyder
University of Michigan, Hwy. Safety Res. Inst.
Rept. No. SAE-770154; 1977; 65p 202refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 236

AIR BAG UPDATE-RECENT CRASH CASE HISTORIES

Eleven case histories of recent traffic accidents which involved cars equipped with the General Motors (GM) air cushion restraint systems (ACRS) are reported. The sample of accidents was selected with a view to showing how the ACRS has reacted in a certain set of circumstances, i.e. circumstances that resulted in injuries rated 3 or 4 on the Abbreviated Injury Scale (AIS) to at least 18% of the occupants of non-air-cushion vehicles in similar accident conditions. Since deployments also occur at impact levels somewhat below those that would normally cause AIS 3 or 4 injuries to unrestrained occupants, this selection does not purport to represent a complete cross section of ACRS deployment accidents. Statistically valid conclusions cannot be drawn from the safety benefits of the ACRS to date (over 400 million vehicle miles in about 11,000 air-cushion-equipped cars), the sample of accidents presented herein illustrates the protection provided by the air cushion in a variety of situations.

by George R. Smith
General Motors Corp., Environmental Activities Staff
Rept. No. SAE-770155; 1977; 14p
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 237

AN ASSESSMENT OF THE RELATIONSHIP BETWEEN FRONTAL IMPACT SEVERITY AND INJURY LEVEL

The relationship between crash severity and injury level is illustrated using data from the Restraint System Evaluation Study (RSES), sponsored by the Motor Vehicle Manufacturers Assoc. in 1974 and 1975, and Texas police-reported data. First, the development and explanation of the separate concepts of "injury risk" and "crash exposure" are discussed by a review of the various methods used to address this topic in the existing literature. The RSES data are then used to demonstrate that the probability of an injury (or fatality) is a function of both the risk of injury, given a set of crash factors, and crash exposure, or the chance of those factors occurring. Next the Texas data are used to demonstrate that crash exposure can change with time. Changes in crash exposure can alter the distribution of injuries (or fatalities) independently of motor vehicle standards or design. Finally, Texas and CPRI (Collision Performance and Injury Report) data are used to demonstrate that the risk of fatality is associated with many crash factors other than the traditional speed-related severity measures. A complete understanding of the variables involved requires analytic techniques and models that encompass all factors and their interactions; collision severity is only a part of this model.

by Joseph C. Marsh, 4th; Kenneth L. Campbell; Barbara C. Kingman
University of Michigan, Hwy. Safety Res. Inst.
Rept. No. SAE-770156; 1977; 15p 24refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977. Based on SAE-750921 "An Assessment of the Relationship Between EBS and Fatalities," presented at Automobile Engineering and Manufacturing Meeting, 15 Oct 1975.
Availability: SAE

CONTROL SYSTEMS

Traditional methods of analog-to-digital conversion, developed mostly for military and scientific applications, do not meet the needs of the automotive industry including cost objectives, speed and accuracy goals, and such desirable features as ratiometric operation, single supply operation, low power, wide input and supply ranges, inherent filtering, and minimum of trimmed components. Two circuits and approaches are recommended: the 4151/7151 is shown for single input relatively slow applications and the microA0850, a new monolithic IC (integrated circuit), is described for complex multi-input control systems. Analog sensors and analog-to-digital conversion can be economically applied when designed as an integral part of a microprocessor-based system.

by Larry Kendall
Fairchild Camera and Instrument Corp., Semiconductor Div.
Rept. No. SAE-770159; 1977; 8p
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 239

PROGRESS IN HSLA STEELS IN AUTOMOTIVE APPLICATIONS

Progress in the technical developments in high-strength, low-alloy (HSLA) steels in automotive applications includes automotive weight reduction programs which have inspired the development of flat-rolled steel products that display various combinations of strength and formability. High strength hot-rolled materials have been developed through microalloying, nitrogen addition, and heat treatment (dual phase). Processes for increasing the strength of cold-rolled steels include microalloying, nitrogen addition, heat treatment (dual phase), heavy-temper rolling, and controlled annealing. The strength-formability relationships achieved through these different developmental approaches permit substitution for traditional flat-rolled materials in a wide variety of automotive applications. Results of laboratory and mill experiments using these technical advances are presented.

by R. P. Krupitzer; R. E. Miner; P. J. Vander Arend; F. Reis;
J. A. Slane; J. K. Abraham; S. J. Matas
Republic Steel Corp., Res. Center
Rept. No. SAE-770162; 1977; 12p 16refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 240

PARTIALLY ANNEALED HIGH STRENGTH COLD ROLLED STEELS

Techniques are described wherein certain high strength cold-rolled steels with yield strengths between 60 and 160 ksi (413 and 1102 MPa) can be produced by recovery annealing. These steels, which are being utilized in automotive weight reduction programs, have proved to exhibit good property uniformity from the standpoints of strength, ductility, weldability, gauge, and shape. Recovery annealing is useful because strength

controlling factors, as-hot-rolled yield strength and percentage cold reduction, allows production of a range of yield strengths. Changes in steel chemistry and intermediate thermal-mechanical processing can provide increased annealing control and allow for variation of such properties as inclusion control and total drawability or stretchability. Specific examples in automotive design and application of these unique materials are described; most are in safety-related applications such as side-door intrusion beams. The increasing number of successful applications of these steels in areas where their combination of strength and cost effectiveness fills specific needs is a good example of resourceful design and material utilization by the automotive industry.

by P. B. Lake; J. J. Grenawalt
Youngstown Sheet and Tube Co.
Rept. No. SAE-770163; 1977; 14p 6refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 241

HIGH STRENGTH FORMABLE SHEET STEEL

A high-strength, formable sheet steel, VAN-QN, is obtained by careful heat treatment of cold-rolled or hot-rolled steel such that a microstructure consisting of fine ferrite grains with a controlled dispersion of martensitic or lower bainitic areas is formed. This product is characterized by general yielding at a relatively low level (50-60 ksi) with a rapid rate of work hardening combined with a large capacity for deformation that results in a high tensile strength (80-100 ksi) and a high degree of strengthening in the formed part. For the automotive industry, VAN-QN offers the potential for levels of weight reduction and improved safety performance in difficult to form parts that cannot be matched with as-rolled steel. For cost-effective application, VAN-QN will clearly be appropriate for the most demanding applications. Forming trials on applications of this type such as bumper facebars have been encouraging. The levels of weight reduction obtainable are typical of those achievable with conventional 80,000 psi minimum yield strength steels. To obtain optimum formability at a given tensile strength, careful control of chemistry and processing is necessary to produce the required mixture of ferrite and martensite. Moreover, there is a strong correlation between the amount of martensite and obtaining the required combination of strength and ductility in the VAN-QN product.

by J. H. Bucher; E. G. Hamburg
Jones and Laughlin Steel Corp.
Rept. No. SAE-770164; 1977; 12p 7refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 242

STRAIN AGING PROPERTIES OF HIGH-STRENGTH HOT-ROLLED STEELS

To determine the steel best suited for the strain aging process, the static and dynamic strain aging characteristics were determined for carbon steel and various hot-rolled high strength

steels representing yield strengths from 40 ksi (276 MPa) to 107 ksi (738 MPa). This study was prompted by the possibility of using the strain aging process to meet the need of the automotive industry for low cost, high strength steel. In static strain aging the material is deformed at room temperature and then is aged at a given elevated temperature. This process is actually quite common in automobile plants where steels are formed initially and then subjected to a paint-baking operation. In dynamic strain aging both deformation and aging take place simultaneously at elevated temperatures. This process is uncommon in the production of automotive components at the present time but could receive more attention in the future as the demand for greater formability in high strength products is increased. Ten steels representing the following four types of hot-rolled low carbon steel were investigated: plain carbon (C-Mn-Al); interstitial, renitrogenized (N); substitutional, rephosphorized (P); and precipitation, microalloyed (Cb,V,Ti). The medium strength (40/50 ksi (276/345 MPa)) renitrogenized steels with high soluble nitrogen levels were found to offer an excellent combination of good ductility, large strain aging response, and high strength levels in the finished automotive part at low cost. For difficult forming operations, the dynamic strain aging process utilizing the titanium-strengthened 80 ksi (552 MPa) steel offers a useful technique, providing improved ductility at elevated forming temperatures while retaining high strength levels in the finished part.

by R. L. Pastorek; A. B. Sipler
Youngstown Sheet and Tube Co.
Rept. No. SAE-770165; 1977; 14p 9 refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 243

AUTOMOTIVE SULFATE EMISSIONS--A BASELINE STUDY

A baseline testing program to study automotive sulfate emissions was designed and implemented by the Environmental Protection Agency (EPA) wherein 78 vehicles were tested in five laboratories. The objectives of the study were as follows: to obtain sulfate emission factors on a wide variety of different in-use vehicles using current and advanced emission control methods, and to determine the effect on sulfate emissions of vehicles meeting increasingly stringent gaseous emissions standards. The program was designed such that the vehicles were divided into the following classes: production, non-catalyst, production catalyst (grouped according to emissions standards), advanced noncatalyst, advanced catalyst, and fleet. Oxidation catalyst vehicles were found to have significantly higher sulfate emission rates than either current or prototype noncatalyst gasoline-fueled vehicles when tested over the Congested Freeway Driving Schedule (CFDS). In general, oxidation catalyst vehicles equipped with air pumps were found to have higher sulfate emission rates than oxidation catalyst vehicles without air pumps. However, both air pump and non-air-pump vehicles exhibited a wide variation in sulfate emission rates. In general, sulfate emission rates were found to increase with decreasing hydrocarbon (HC), carbon monoxide (CO), and nitrogen oxides (NOx) levels although substantial ranges were found between vehicles at each level of HC/CO/NOx control. The three-way catalyst and advanced noncatalyst gasoline-fueled vehicles tested were found to have CFDS sulfate emission rates no higher than those typical of current noncatalyst gasoline-fueled vehicles. However, addition of an

air-injected oxidation catalyst downstream of a three-way catalyst, or addition of an oxidation catalyst to a lean-burn catalyst system, was found to result in the higher sulfate emission rates typical of airpump-equipped oxidation catalyst systems. The light-duty diesel vehicles tested were found to have CFDS sulfate emission rates significantly higher than those of other noncatalyst vehicles tested, averaging 6.5 mg/km.

by Joseph H. Somers; Robert J. Garbe; Richard D. Lawrence; Thomas M. Baines
Environmental Protection Agency
Rept. No. SAE-770166; 1977; 19p 31 refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 245

EMISSION PATTERNS OF DIESEL-POWERED PASSENGER CARS--PT. 2

An experimental program was conducted to characterize the gaseous and particulate emissions from a 1975 Peugeot 504D light-duty diesel-powered car. The vehicle was tested over the 1975 Federal Test Procedure (FTP), Hwy. Fuel Economy Test (HWFET), and Sulfate Emissions Test (SET) driving cycles using four different fuels (Jet A, Local No. 1, Nat'l avg. No. 2, No. 2-D) covering a fair range of composition, density, and sulfur content. Diesel-powered cars have low regulated emissions and good fuel economy; the magnitude of the regulated emissions appears dependent upon test cycle and fuel property. Aldehyde emissions are significant, representing about 12% of the total hydrocarbon (HC) emissions and constitute an appreciable fraction of the photochemical oxidant potential of diesel exhaust. Low molecular weight HC are mainly ethylene and do not comprise a major portion of total HC emitted. The majority of the emitted HC have molecular weights similar to that of the test fuel. Hydrogen cyanide (HCN) emissions are relatively low (1.0 to 1.9 mg/mile) in the 1975 FTP. The particulate mass emission rate is approximately 350 mg/mile and increased with increasing fuel aromaticity. Elemental carbon particles comprise from 64% to 91% of the particulate matter and particulate emissions are greater in the 1975 FTP than in either the HWFET or SET cycles. Trace metals and other emitted elements are of little consequence. Nickel is the only potentially toxic element emitted, in the trace quantity of 0.01 mg/mile. Fuel sulfur is emitted primarily in the form of gaseous SO₂ (sulfur dioxide) with a minor fraction (1% to 3%) emitted as sulfate. SO₂ and sulfate emissions increase with increasing fuel sulfur and are greater in the 1975 FTP than in either the HWFET or SET cycles. Sulfate emissions are still significant (approximately 8.9 mg/mile in the 1975 FTP using Nat'l avg. No. 2 diesel fuel) and are comparable to those obtained from some current 49-state catalyst vehicles and other light-duty diesel-powered vehicles. Carbonyl sulfide (COS) emissions are relatively low (0.2 to 0.6 mg/mile). Benzo[a]pyrene (BaP) emissions are relatively low (0.29 to 2.11 microg/mile) and are comparable to those obtained from other light-duty diesel-powered vehicles; the magnitude of BaP emissions appears dependent upon test cycle and fuel property.

by James N. Braddock; Peter A. Gabele
Environmental Protection Agency
Rept. No. SAE-770168; 1977; 13p 36 refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

Exhaust emission data for 1975 and 1976 California automobiles were generated using the Federal Test Procedure (FTP), both at the time of the cars' delivery (green engines) and after their engines had matured. The aggregate hydrocarbon (HC), carbon monoxide (CO), and nitrogen oxides (NOx) exhaust emissions for both the 1975 and 1976 model year cars were approximately the same. A larger proportion of 1976 autos with green engines (67%) failed to pass one or more of the California emission standards (0.9 g/mile for HC, 9.0 g/mile for CO, and 2.0 g/mile for NOx) than 1975 cars with green engines (57.5%). Likewise, a larger proportion of 1976 cars with mature engines failed to pass one or more of the standards (72.5%) than 1976 autos with green engines. The reductions of exhaust emission levels from pre-1966 uncontrolled autos were in excess of 90% for both HC and CO and approximately 50% for NOx. The failure of some cars to meet the required emission standard offset those HC, CO, and NOx reductions by 1%, 2%, and 10%, respectively. The aggregate emission levels and the rate of failure of cars to meet California standards indicate that NOx has been the most difficult pollutant to control. However, this problem may be accentuated by the success of the catalytic reactor in controlling HC and CO emissions. The significance attached to failure of autos to pass the California CO standard should be minimized. The California (Los Angeles area) ambient air quality and its associated health problems may not be affected by the amounts of CO emitted from new cars. Current cars manufactured to comply with California standards indicate the contribution of automobile emissions to air pollution will be greatly reduced in the future years. In view of increasing costs, e.g. catalytic converters, future countermeasures to reduce ambient air pollution should be directed to other pollution sources. Any further auto emissions standard changes contemplated should be weighed with regard to other trade-off factors which have increasing future significance.

by M. R. Appleby; L. J. Bintz; T. A. Tappenden
Automobile Club of Southern California
Rept. No. SAE-770169; 1977; 8p 4refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 247

AUTOMOTIVE FUEL FED FIRE--A PREVENTATIVE APPROACH

The design of a cellular fuel tank to help reduce the risk of fuel-fed automotive fires allows for construction in various media such as steel, aluminum, dual bag of various materials, metal/plastic combination, and laminates. While preliminary work was done with aluminum for ease in fabricating prototypes, the second generation tanks through recent technology with synthetics are made in dual-bag versions. To avoid mechanical sensing problems in mixing the fuel and the Freon fluids (extinguishing agents), the system of cellular tanks is completely passive, allowing for automatic mixing of the fluids during the impact phase without any reliance on accessory devices. The tank has proven to be mechanically stronger upon impact than the conventional FIA tank having twice normal bag thickness. It appears that the plastic foam used in the tanks when filled with Fluobrene absorbs some energy of the

by C. Chiti; S. Garbarino
Alfa Romeo, Autodelta S.p.A., Italy
Rept. No. SAE-770170; 1977; 10p 3refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 249

REAR BODY CONSTRUCTION OF SUB-COMPACTS AND FUEL SYSTEM INTEGRITY IN REAR END COLLISIONS

Results are presented of experimental investigations of how fuel system integrity in rear-end collisions is affected by differences in rear suspension, rear body construction, fuel tank arrangement, etc., with regard to unitary constructed subcompact cars. Two different types of conventional fuel tank arrangements were studied: the fuel tank in the luggage compartment and the fuel tank under the rear floor panel behind the rear axle. It was confirmed that further improvement in fuel system integrity could be achieved by controlling rear body crushworthiness corresponding to each fuel tank arrangement. Especially with regard to the fuel tank under the rear floor panel, crash energy must be absorbed by body deformation both in front of and behind the tank, while at the same time deformation of the rear floor surrounding the tank and the tank itself must be prevented so that the fuel tank makes no contact with the rear suspension system. The designs for two types of rear body construction which are more acceptable from the standpoint of fuel system integrity are presented.

by Kazutoshi Arima; Kiyokazu Seo; Tamio Arakawa
Toyota Motor Co., Ltd., Japan
Rept. No. SAE-770171; 1977; 16p 2refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 250

POSSIBLE EFFECTS OF FMVSS 301 ON MOTOR VEHICLE DEVELOPMENT AND DESIGN

An analysis is made of the additional cost to the auto industry in developmental work and vehicle equipment brought about by the introduction of FMVSS (Federal Motor Vehicle Safety Standard) 301. A requirement of FMVSS 301 for model years 1976 and 1977 is that only limited fuel leakage may occur during a frontal, 0/-30° frontal barrier crash test, lateral and rear end collision with a 4000-pound barrier and subsequent constrained rollover. Too much outlay is required by the test procedures for the vehicle fuel tank system. The omission of the lateral impact tests would be justified. Also, dummies should be used only if the tests include injury criteria; however, the use of dummies should be permitted in those tests where dummy data are to be obtained, e.g. for FMVSS 208. All other tests should be conducted on vehicles in curb-weight conditions. The outlay for testing and development work could be substantially reduced without detriment to safety benefit,

HS-022 272

so that more funds would be available for the development of other safety elements.

by Ulrich Seiffert; Arnold Ensslen
Volkswagen A.G., Res. and Devel., Germany
Rept. No. SAE-770172; 1977; 12p 8refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 272

AUTOMOTIVE MANUFACTURING AND AUTOMOTIVE COMPONENT HISTORICAL CONTRACT 1970-1975. FINAL REPORT

Historical data on the operating characteristics, life cycle costs, and manufacturing characteristics of automotive vehicles and components of the U.S. automobile fleet for model years 1970 through 1975 are summarized. The project is described in the following sections: detailed statements of work required, criteria of data sources, data tabulations, automobile manufacturing plants, and sources of data. (Most of data are appended under separate cover.) Included herein are a listing of the automotive assembly and component manufacturing facilities in the U.S., and tables of estimates of the costs in 1974 dollars to build new assembly and manufacturing facilities for vehicles, bodies, stampings, engines, and transmissions, including foundries.

by R. G. Fitzgibbons; L. H. Lindgren; J. Milne; Pete Kapielyan; Paul Brown; C. Gruener
George Clayton Associates, 25711 Southfield Rd., Southfield, Mich. 48075; Rath and Strong, Inc., Lexington, Mass.; Chilton Co., Radnor, Pa.
Contract DOT/TSC-1039
1976; 134p 45refs
See also HS-022 273 (Appendices 1, 2, 3, and 4).
Subcontracted to Rath and Strong, Inc., and to Chilton Co.
Availability: Transportation Systems Center, Kendall Square, Cambridge, Mass. 02142

HS-022 273

AUTOMOTIVE MANUFACTURING AND AUTOMOTIVE COMPONENT HISTORICAL CONTRACT 1970-1975. FINAL REPORT. APPENDICES 1, 2, 3, AND 4

Tabulated data on the operating characteristics, life cycle costs, and manufacturing characteristics of automotive vehicles and components of the U.S. automobile fleet for model years 1970 through 1975 are presented. The following information is given: a numbered parts list (identified with UPG (Uniform Product Grouping) codes) of significant components for 210 vehicles manufactured in the years 1970-1975, selling prices and discounts for these components, the designation of the commonality of these parts among the 210 vehicles, weight and materials data for the significant components of three 1975 Chrysler cars (Valiant, Satellite, and Fury), weight and materi-

als data for the significant components of the 1972 Oldsmobile, and Chrysler UPG codes.

by R. G. Fitzgibbons; L. H. Lindgren; J. Milne; Pete Kapielyan; Paul Brown; C. Gruener
George Clayton Associates, 25711 Southfield Rd., Southfield, Mich. 48075; Rath and Strong, Inc., Lexington, Mass.; Chilton Co., Radnor, Pa.
Contract DOT/TSC-1039
1976; 319p
See HS-022 272 for main body of rept. Subcontracted to Rath and Strong, Inc., and to Chilton Co.
Availability: Transportation Systems Center, Kendall Square, Cambridge, Mass. 02142

HS-022 274

EVALUATION OF FREEWAY-MERGING SAFETY INFLUENCED BY RAMP-METERING CONTROL

The traffic-control technique (TCT) was modified to increase the relative safety of freeway merging with and without use of entrance ramp-metering control. Six types of conflicts were defined for the entrance ramp and acceleration lane as follows: braking on ramp, braking for lead vehicle weaving around lead vehicle, entering second lane, side by side, and entering late. The following five vehicle types were specified for the freeway lane (merge lane) and the acceleration lane: weaving around entering vehicle, for entering vehicle, weaving around lead and entering vehicle, braking for lead and entering vehicles, and avoiding a weaving vehicle. A three-level severity rating (minor, moderate, and serious) was also developed to assess the seriousness of each conflict. An existing ramp-metering control was investigated during freeway levels of operation classified as either C or D. A two-way analysis of variance was performed on the traffic-conflict data by using, as dependent variables, ramp-control condition (on and off) and freeway level of service. The study revealed a significant reduction of 11.6% in all traffic conflicts when ramp-metering was activated. Analysis results indicate that acceleration lane conflicts significantly decreased when ramp-metering was used. Merge-lane conflicts were found to be related to freeway level of service than to ramp control. In the merge-lane, multiple-vehicle conflicts and their frequency decreased when ramp control was in effect. An analysis of incident records supported these conclusions. This application of the TCT, using 11 traffic conflicts based on freeway patterns and classified by severity, demonstrated its use as a rapid and valid evaluation technique in the freeway setting; further testing of this modified technique for entrance ramps is warranted.

by Bartholomew T. Cima
Public Transportation Research Record 630 p44-51 (1977); 8refs
Sponsored by Com. on Effectiveness of Operational Management
Availability: See publication

HS-022 275

JOAN CLAYBROOK: AN INTERVIEW

Ms. Claybrook, Administrator of the National Highway Traffic Safety Administration (NHTSA), answers questions regarding the functions of and steps of investigation of the Safety Program (as well as the role of the trial lawyer in the program); implementation schedule for fuel economy s-

for 1978-1985; the safety impact of smaller cars; the present schedule for the phasing in of passive restraints; air bags (effectiveness, public acceptability and education, estimated cost to the consumer, GM's statement comparing number of lives saved using lap and shoulder belts with those using air cushions, Volkswagen's passive automatic belt system as an alternative to the air bag, the mutagenicity and/or carcinogenicity of sodium azide (used to inflate the air bag)); standards to protect pedestrians; safety standards for motorcycles, vans and light trucks; crashworthiness rating of cars; and consumer information requirements.

by Mary Fisk
Publ: Trial v14 n1 p26-9 (Jan 1978)
1978
Availability: See publication

HS-022 276

THE EFFECT OF TIRE GRADE LABELING

A panel of experts was questioned about the National Hwy. Traffic Safety Administration's (NHTSA) proposed Uniform Tire Quality Grading (UTQG) rules, with respect to their possible effectiveness and benefits to the consumer. Once enacted, the UTQG rules will require tire makers to label tires with symbols grading the tire's tread life, high-speed heat resistance, and traction to help the consumer make a more intelligent purchasing decision. The response of all the panel members was negative; these panelists included representatives of the following: General Motors Corp., TRANSPLEX/OSU, Ohio State Univ., Amoco Tools Inc., Goodyear Tire and Rubber Co., National Tire Dealers and Retreaders Assoc., Hennessy Industries, Hunter Engineering Co., and American Retreaders Assoc. Credentials are presented for each of the participants in this discussion.

by William B. Whitney, mod.
Publ: Tire Review v78 n1 p22-6 (Jan 1978)
1978
Availability: See publication

HS-022 277

1977 FEDERALLY COORDINATED PROGRAM OF HIGHWAY RESEARCH AND DEVELOPMENT

The annual report for Fiscal Year 1977 of the Federally Coordinated Program (FCP) of highway research and development is presented. The FCP provides a means of coordinating highway research and development projects at both the state and Federal levels. The first section of the report focuses on the major fiscal year accomplishments grouped into the following common objective areas: improving safety through highway design, traffic controls, and pedestrian improvements; increasing highway efficiency; responding to adverse environmental conditions through highway design and engineering; preserving the environment through highway location and design; and construction cost effectiveness, low maintenance cost, and energy conservation. The second section of the report discusses the mission and goals, organization, services, and funding of the FCP of highway research and development. Information is presented on technical publications, information transfer and reporting services, project engineers, and FCP

categories and their projects. Included are a telephone directory and a table of acronyms and abbreviations.

Federal Hwy. Administration, Offices of Res. and Devel.,
Washington, D.C. 20590
1977; 76p 4refs
Availability: GPO \$2.50, Stock No. 050-001-00130-6

HS-022 278

IDENTIFICATION OF HAZARDOUS LOCATIONS [ON HIGHWAYS]. A USER'S MANUAL. FINAL REPORT

This user's manual describes and illustrates a procedure developed for identifying hazardous locations on all highway facilities except freeways and in the Central Business District (CBD). A Hazardousness Rating Formula is presented which provides a means for arriving at a Hazardousness Index for any suspect site. The formula incorporates data inputs for three accident indicators (number of accidents per year, accident rate (accidents per million entering vehicles), and accident severity), four objective non-accident indicators (sight distance, volume/capacity ratio, traffic conflicts, and erratic maneuver counts), and two subjective non-accident indicators (driver expectancy and information system deficiencies). Data requirements and collection procedures are defined, the necessary charts and computation forms presented, and an illustrative example provided.

by J. I. Taylor; H. T. Thompson
Pennsylvania State Univ., Pennsylvania Transportation Inst.,
University Park, Pa. 16802
Contract DOT-FH-11-8279
Rept. No. FHWA-RD-77-82; PTI-7602; 1977; 92p 34refs
Part of Federal Hwy. Administration Proj., "Development of Procedures For Identifying Hazardous Locations."
Availability: NTIS

HS-022 279

IMPROVEMENT OF THE REAR SIGNAL ARRANGEMENT ON MOTOR VEHICLES BY MEANS OF ADDITIONAL HIGH MOUNTED STOP (BRAKE) LIGHTS (VERBESSERUNG DES RUCKWARTIGEN SIGNALBILDES AN KRAFTFAHRZEUGEN DURCH ZUSATZLICHE HOCHGESETZTE BREMSLEUCHTEN)

The effect of the addition of high-mounted brake lights on the rear signal arrangement of motor vehicles, on the reaction time of individual drivers in a line of traffic was examined. Studies were conducted dynamically with a line of five vehicles at driving speeds between 50 km/h and 100 km/h on frequented roads during the day and at night. All vehicles were equipped with conventional stop (brake) lights. The first vehicle in the line was equipped with additional high-mounted brake lights which could be selectively connected to the conventional brake lights. The additional lights were mounted inside the vehicle at a height of 1.25 m in the rear window. The time which passed from the start of braking of the first vehicle in the line to the start of braking of the second, third, fourth, and fifth vehicles was selected as the test criterion. Reaction times of drivers were taken first with vehicles equipped only with conventional brake lights; these results were then compared with those obtained when the first vehicle in the line was equipped with the additional high-mounted lights. Results of

curred in nighttime and daytime driving. It is concluded that it is necessary to equip each vehicle with high-mounted brake lights; equipping every fifth or sixth vehicle would suffice.

by Hans-Joachim Schmidt-Clausen

1977; 17p 8refs

Text also in German.

Availability: Techtran Corp., P.O. Box 729, Glen Burnie, Md.

HS-022 280

A CONTROLLED STUDY OF THE ROLE OF ALCOHOL IN FATAL PEDESTRIAN ACCIDENTS

The first large-scale controlled investigation of the role of alcohol in adult pedestrian fatal accidents was conducted. A comparison of the blood alcohol concentrations (BAC) of 344 fatally injured pedestrians with those of a matched control group of 1118 non-accident-involved pedestrians has shown the increased risk of pedestrian accident involvement associated with BAC above 120mg/100 ml. Among males, impaired pedestrians (BAC greater than or equal to 120 mg/100 ml) were overrepresented among the 15-64 age group, unmarried and divorced or separated persons, and semiskilled and unskilled workers. In many cases, a high BAC appeared to be the result of normal drinking habits. Routine blood alcohol screening of all pedestrian casualties is a potentially useful aid in the detection of alcohol-dependent individuals.

by A. B. Clayton; A. C. Booth; P. E. McCarthy
Publ: Zeitschrift fur Verkehrssicherheit v3 n3 p106-9 (1977)
1977; 7refs

Includes German and French summaries. Presented at 7th International Conference on Alcohol, Drugs, and Traffic Safety, Melbourne, Jan 1977.
Availability: See publication

HS-022 281

FUEL-FED VEHICLE FIRES

Impacted areas most frequently resulting in vehicle fuel leakage are the rear and the side-rear site of fuel filler pipes. The likelihood of fuel leakage increases with the severity of collision. Some examples of poor fuel tank design are the Ford "drop-in" fuel tank, and fuel tanks in Ford Pinto and the 1971-1973 Chevrolet Vega. Two prime safety principles are locating the tank away from areas where rupture is likely, and manufacture for more effective retention of the tank's contents. Among the preferred locations are the area above the rear axle, or under the rear seat, separated from the passenger compartment by the floor pan (VW Rabbit and Ford Fiesta). Basic fuel tank design criteria include simple system design, location in areas least vulnerable to impact, increased resistance of components most vulnerable to impact damage, no separation of the fuel system from fire ignition sources. Fuel tank components, such as the anchorage, filler neck, venting system, and connections to fuel pipes, are possible sources of fuel leakage. The characteristics of a well designed gas tank include high distortional capability and high strength, resistance to corrosion inside and outside, and nonsparking characteristics when ruptured. A horizontally aligned rectangu-

bladder enclosed in a metal tank. One design uses a bladder and a polyurethane expansion cell within a metal tank. A honeycomb-like matrix inside a fuel tank would resist heat buildup and prevent explosion. The self-sealing breakaway valve automatically seals upon separation of components. Such valves would be located between the fuel tank and pump, at the filler outlet, and within the tank vent in an evaporation emission control system. Fuel lines could be routed around hazardous areas and reinforced with steel coverings. The use of a flapper valve in the filler opening, a flexible filler tube, a vent-line check valve, and careful routing of a steel fuel outlet are recommended to avoid fuel spillage. Federal Motor Vehicle Safety Standard No. 301 requires that a 30 mph frontal barrier impact result in no fuel leakage greater than one ounce per minute from the fuel tank, pipe, and connections. The standard also finally adopted a 20 mph frontal and frontal angular impacts, a 20 mph side impact into the door area, a 30 mph rear impact static rollover tests. In spite of this legislation, motor vehicle fuel systems still do not meet the state-of-the-art.

by John Hubbard; Virginia Kelly; Russell Shaw
Publ: Trial v14 n1 p30-4 (Jan 1978)
1978

References available from publication on request.

Availability: See publication

HS-022 284

DRIVER LICENSE AND DRIVER IMPROVEMENT PROGRAM. A NATIONAL REVIEW

A survey was conducted in each of the six Australian states and two territories to gather data on existing programs for driver license and driver improvement. The present programs attempt to keep poor drivers off the road by denial of license and operates a point demerit system which, in most cases, automatically suspends or cancels licenses. This approach to driver license administration is no longer feasible. Within the context of the social/legal/political system, license selection programs are very inefficient since passing scores must be low enough to allow the vast majority of license applicants to pass. Denial of licenses to a large segment of society is unrealistic, as to do so would affect the daily lives of most people. Effectiveness of driver licensing and driver improvement programs is difficult to ascertain since crashes are rare events and most drivers would not be predicted to experience a crash within any given year. About 80% of crashes in a given year involved drivers who have not experienced violations or crashes during the previous two years. A model system is proposed which allows entry into the initial license process at an early age, then determines increasing proficiency in the early months of driving. This process would employ a classification system to establish subgroups of drivers in need of further education and training. A series of driver improvement techniques for use with poor drivers is recommended. The implementation of these programs would, however, be dependent upon demonstrated effectiveness. Points demerits scheme would form the basis of identification of target populations replacing their present use as automatic sanctioning device. The Dept. of Transportation should be the leader in research on driver testing, emphasizing nationwide standardization of improvement in driver testing and paying particular attention

Importation of small pickup trucks is expected to total nearly 350,000 units in 1977.

by Robert V. Coleman; Thomas C. Meehan
Publ: U.S. Industrial Outlook 1978 ch 15 p147-59
1978
Availability: See publication

HS-022 288

COMPARATIVE DATA REPORT 1974

Comparative information is presented relating to state police, state highway patrol, and provincial police administration. Included is an analysis and identification of significant trends and highlights of state police and highway patrol administration. Comparative tables on related executive, judicial, and legislative data include significant legislation and court decisions, federally funded projects, state/provincial aid programs, and police employee organizations. Also included are environmental programs, vehicle codes, speed policies, and compacts, as well as legislation for control of firearms, drug and alcohol abuse, and organized crime. Comparative data tables on administration include organization/structure, decentralization of field force, budget, and personnel, as well as accident and criminal assault experience. Employee benefits, time expenditure, patrol statistics, and safety programs are also included. Operations data tables include the internal directive system, planning and research, internal affairs, inspections and equipment. Statistics on crime laboratory, microfilming, fingerprints, composite drawings, and questioned documents are included, as are reports from the ballistics, narcotics, intelligence, and youth units. Data tables on services include records, data processing, services to local agencies, and statistics. Tabulated data are provided on recruitment, selection, training, and promotion, including such items as selection criteria for trooper appointment and assignment, and transfers.

International Assoc. of Chiefs of Police, Div. of State and Provincial Police, 11 Firstfield Rd., Gaithersburg, Md. 20760
Grant LEAA-75-SS-99-6003
1974; 271p
Availability: Corporate author

HS-022 289

ENCOURAGING SCHOOL TRANSPORTATION EFFECTIVE ENERGY MANAGEMENT (ESTEEM). FUEL ECONOMY MANAGEMENT HANDBOOK FOR DIRECTORS OF PUPIL TRANSPORTATION, SCHOOL DISTRICT ADMINISTRATORS, AND TRANSPORTATION DEPARTMENT MANAGEMENT

A summary of programs, actions, and measures is provided for saving fuel and dollars in pupil transportation. The following management steps are suggested: definition of problems, accumulation of facts on fuel, equipment, labor etc., decisions on solution of problems, action, and evaluation. Increased vehicle occupancy, reduced travel mileage, and more energy efficient vehicles are recommended, as are preventive maintenance, and personnel training and motivation. Checklists of administrative actions and fuel economy tips are provided, as well as tips on saving energy in other areas of school operation. Factors affecting fuel economy include horsepower, air and rolling resistance, and performance on grades and hills. Other factors are altitude, driving habits, and maintenance. Engine efficiency is affected by air-fuel ratio, spark timing,

compression ratio, and engine speed and load factor. I selection for the task to be performed can aid in fuel economy (diesels recommended). A public relations campaign is suggested for increased pupil and parent support for the economy program. Proper equipment selection for fuel economy includes such items as transmissions, tires, and ten-ture-controlled engine cooling fans. Turbocharged engines, governors, performance recorders, alarms, and radio equipment are also recommended.

BRI Systems, Inc., Phoenix, Ariz. 85068
1977; 158p 151refs
Fuel Economy Through Teamwork Publication Series. See also HS-022 290--HS-022 294.
Availability: Department of Transportation, Voluntary Tr and Bus Fuel Economy Prog., Washington, D.C. 20461

HS-022 290

FUEL ECONOMY THROUGH TEAMWORK. 1. PI TRANSPORTATION AND ENERGY CONSERVATION

In the first of a series of five booklets giving tips for saving school transportation, guidelines and suggestions to school transportation administrators in achieving better economy and cost management goals are presented. Following a basic description of energy, the following questions are addressed: how much energy does America use, where does energy go, what can be done to reduce energy use, where energy conservation in pupil transportation a major concern, what motivation is there for conserving fuel, how pupil transportation costs be reduced, what is a fuel economy management program, how is a fuel economy management program organized, why are administrative policies important in saving fuel, what can be done to save fuel in vehicle operation, what else contributes to fuel economy, where do profits fit into the program, can all school districts take advantage, a fuel economy program, where does one start in initiating economy management, and what steps should be taken to initiate the district's program.

BRI Systems, Inc., Phoenix, Ariz. 85068
1977; 20p 1ref
Energy Savings in School Transportation Publication Series. See also HS-022 289 and HS-022 291--HS-022 294.
Availability: Department of Transportation, Voluntary Tr and Bus Fuel Economy Prog., Washington, D.C. 20461

HS-022 291

FUEL ECONOMY THROUGH TEAMWORK. 2. PURCHASING FOR FUEL ECONOMY

In the second of a series of five booklets giving tips for saving energy in school transportation, guidelines and suggestions given for purchasing equipment that saves fuel. The following tips are outlined: purchase school buses that offer good economy, use sound economic policy to evaluate purchase equipment that will help schoolbus drivers to do for fuel economy, consider options that offer fuel economy your purchases, purchase equipment that will allow the maintenance staff to do a better job in keeping the efficiency of schoolbus fleet at its maximum potential, consider options such as two-way radios, and purchase wisely and purchase fuel economy. First-order measure of purchase benefits (at investment's payback period (years)) and second-order mea

June 30, 1978

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of purchase benefits (investment benefit-cost analysis) are explained.

BRI Systems, Inc., Phoenix, Ariz. 85068

1977; 8p 1ref

Energy Savings in School Transportation Publication Series. See also HS-022 289, HS-022 290, and HS-022 292--HS-022 294.

Availability: Department of Transportation, Voluntary Truck and Bus Fuel Economy Prog., Washington, D.C. 20461

HS-022 292

FUEL ECONOMY THROUGH TEAMWORK. 3. DRIVING FOR FUEL ECONOMY

In the third of a series of five booklets giving tips for saving energy in school transportation, guidelines and suggestions are given for driving for fuel economy. Two sets of detachable pocket mileage records and charts and lists of fuel saving tips are provided. The 18 fuel saving tips are as follows: check that oil, water levels, and tire inflation pressure are proper each time you fill up; gradually accelerate the bus to the desired speed; drive slower when the engine is cold; look ahead and anticipate stops; drive at steady speeds and use the brakes as little as possible; accelerate and decelerate smoothly when changing speeds; plan your traffic moves early; adjust the vehicle speed to the road and weather conditions; shift into high gear as soon as possible, but do not lug the engine; turn corners slowly and change lanes smoothly; turn off the ignition if the bus is to be stopped for more than one minute; do not speed up the engine before turning off the ignition; reduce idle engine warm-up time; do not start the engine until everyone is ready to go; smell for trouble, look for trouble, listen for trouble, feel for trouble (report any problems immediately); maintain patience, courtesy, and good humor; keep accurate records of fuel consumption; and try as many fuel economy techniques as possible to increase your vehicle's miles-per-gallon.

BRI Systems, Inc., Phoenix, Ariz. 85068

1977; 8p 1ref

Energy Savings in School Transportation Publication Series. See also HS-022 289--HS-022 291, HS-022 293, and HS-022 294.

Availability: Department of Transportation, Voluntary Truck and Bus Fuel Economy Prog., Washington, D.C. 20461

HS-022 293

FUEL ECONOMY THROUGH TEAMWORK. 4. OPERATING FOR FUEL ECONOMY

In the fourth of a series of five booklets giving tips for saving energy in school transportation, guidelines and suggestions are given for increasing school district transportation effectiveness which will lead to greater fuel economy. The following factors are considered: planning to obtain better fuel economy, training personnel to achieve increased fuel economy, purchasing to obtain greater fuel economy, operating for fuel economy, maintaining for fuel economy, and communicating with other school districts.

BRI Systems, Inc., Phoenix, Ariz. 85068

1977; 8p 1ref

Energy Savings in School Transportation Publication Series. See also HS-022 289--HS-022 292, and HS-022 294.

Availability: Department of Transportation, Voluntary Truck and Bus Fuel Economy Prog., Washington, D.C. 20461

HS-022 294

FUEL ECONOMY THROUGH TEAMWORK. 5. THE SCIENCE OF SAVING FUEL

In the last of a series of five booklets giving tips for saving energy in school transportation, some of the basic principles of the science of saving fuel are outlined. The following basic elements in considering horsepower requirements of a school-bus and related fuel economy are described: air resistance, rolling resistance, grades and hills, weather effects, and accessories (e.g. engine fan).

BRI Systems, Inc., Phoenix, Ariz. 85068

1977; 8p 1ref

Energy Savings in School Transportation Publication Series. See also HS-022 289--HS-022 293.

Availability: Department of Transportation, Voluntary Truck and Bus Fuel Economy Prog., Washington, D.C. 20461

HS-022 295

THE EFFECT OF DYNAMOMETER INERTIA WEIGHT SIMULATION ON FUEL ECONOMY MEASUREMENTS

Improvements in dynamometer inertia weight simulation in relationship to the accuracy of fuel economy measurements are discussed. Exhaust emissions and fuel economy measurements made by the Environmental Protection Agency (EPA) are done by sampling the vehicle's exhaust while it is operated on a Direct Drive Variable Inertia Flywheel (DDVIF) dynamometer. The vehicle is placed on the rolls of the dynamometer, and the inertia weight and horsepower specified in the Federal Register for that vehicle weight are set. The inertia weight is set by engaging the proper set of flywheels to the dynamometer rolls. Since the simulation of inertia weight is done by use of flywheels, the actual test weight of the vehicle (curb weight 0 300 pounds) cannot be simulated. Instead, the nearest inertia weight setting to the vehicle's test weight is selected. The Federal Register currently specifies inertia weight intervals of 250 pounds for vehicles between 1000 and 3000 pounds test weight and 500-pound intervals for vehicles between 3000 and 5500 pounds test weight for light-duty vehicles. Proposed for 1978 is the requirement to test light-duty trucks at weight intervals the same as for light-duty vehicles but with the weight extended up to 6500 pounds test weight (curb weight 0 500 pounds). In addition, some trucks above 6500 pounds test weight may be tested as light-duty trucks at the manufacturer's option. Weights above 5500 pounds are in 500-pound intervals. With the current inertia weight increments, actual errors as large as 1.6 mpg can occur when testing is done at an inertia weight above or below the proper one for the vehicle's test weight, and these errors occur at the lowest inertia weight class that is currently used for testing (1750 pounds). In addition, a maximum percent error as large as 7% can occur at the 4000 pound inertia weight class. An error as large as 1.6 mpg is unacceptable in that it could allow a change in the measured fuel economy of 2 mpg when a vehicle is tested at the next lowest weight class. A solution would be to use smaller inertia weight increments. Adding inertia weight flywheels on existing dynamometers can reduce the errors associated with inertia weight simulation, but it is desirable to add only enough flywheels to obtain an acceptable level of accuracy. Five dynamometer configurations are presented which might be employed to satisfy the following requirements are presented: inertia weight simulation up to 6500 pounds,

and finer increments in the inertia weight simulation (to improve fuel economy error).

by Thomas R. Norman; Thomas Rarick
Environmental Protection Agency, Standards Devel. and
Support Branch, Ann Arbor, Mich. 48105
Rept. No. PB-272 147; LDTP-76-2; 1976; 29p 5refs
A Technical Support Rept. for Regulatory Action.
Availability: NTIS

HS-022 296

A CRITICAL REVIEW OF SOCIAL COST ESTIMATION OF ALCOHOL PROBLEMS. FINAL REPORT

The feasibility and advisability of basing state and local planning for alcohol problems on social cost estimates were analyzed. The study had the following four objectives: review the literature for appropriate models for estimating the social cost of alcohol, identify the criteria and methodological issues for a valid social cost study, discuss the major economic theories and principles utilized in a social cost study, and make recommendations regarding the feasibility of implementing a system for estimating the comparative social costs of alcoholism and alcohol abuse at the state level. Theoretical, conceptual, and practical difficulties may prevent valid assignment of dollar values to alcohol-related (A/R) problems. The findings are summarized in the following four categories: poor incidence and cost data, lack of agreement regarding A/R proportions of various health and social problem incidence, the use of average cost estimates instead of marginal cost estimates, and lack of practical utility of total average cost figures. On the basis of these observations, it is recommended that state agency personnel and policymakers refrain from relying heavily on the estimates of the total cost of A/R social and health problems at this time. The necessary research to provide missing information may soon be conducted so that accurate costs of various problems related to alcohol can be estimated. It is in the best interest of the state to wait for valid comparative cost estimates. Even when the practical and theoretical obstacles have been overcome, the state should only become invested in the process when the utility of the activity will serve a real purpose in planning and evaluating intervention programs.

by Jay Alan Freedman; Richard L. Douglass
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48109
Contract MDPH-384117
Rept. No. UM-HSRI-77-37-2; 1977; 41p 59refs
Rept. for Oct 1976-Sep 1977. Vol. 2 of "A Study of Alcohol-
Related Casualties and Alcohol Beverage Market Response to
Beverage Alcohol Availability Policies in Michigan."
Availability: Corporate author

HS-022 297

LIGHT DUTY VEHICLE ROAD LOAD DETERMINATION

A study was undertaken to develop equations to predict the dynamometer adjustment forces appropriate to simulate the on-road experiences of light-duty vehicles. When vehicle exhaust emission tests or vehicle fuel consumption measurements are performed on a chassis dynamometer, the dynamometer is usually adjusted to simulate road experience of the vehicle. Road load versus speed data were obtained

from 64 diverse light-duty vehicles. The coast-down in which the forces acting on a freely decelerating vehicle reduced from the speed-time history of the deceleration used for all track measurements. These data were converted to dynamometer adjustment forces appropriate to the on-road experience of the vehicle. It was estimated that further effort should be made to develop road load systems based on vehicle frontal area, and, if estimates of the vehicle aerodynamic drag coefficient

by Glenn D. Thompson
Environmental Protection Agency, Standards Devel. and
Support Branch, Ann Arbor, Mich. 48105
Rept. No. PB-272 291; LDTP-76-3; 1976; 60p 11refs
A Technical Support Rept. for Regulatory Action.
Availability: NTIS

HS-022 298

PREDICTION OF DYNAMOMETER POWER ABSORPTION TO SIMULATE LIGHT DUTY VEHICLE ROAD LOAD

Dynamometer power absorption information from a study on light-duty vehicle road load determination was used to develop equations for predicting the small dynamometer power absorption necessary to simulate load of vehicles. The equations were developed by fitting model equations to predict the dynamometer power, first based on vehicle weight, and then based on the reference frontal area. The estimates of the small dynamometer power absorption for vehicles equipped with radial ply tires were used for evaluating the prediction systems. The latter prediction model was the preferred approach, and was then improved by separating vehicles into different classes and by including estimations of the total frontal area of the vehicle protruberances. Estimated with this prediction system are 20% less than associated with a prediction system based on the weight only. In addition, equations were developed for predicting the small twin roll dynamometer power absorption for vehicles with bias tire construction and for predicting power absorption for single large roll dynamometer equations were developed by incorporating correction factors to the aerodynamic-based equations for predicting the small roll dynamometer power absorption for vehicles with tires. These correction terms are dependent on the tire construction and are proportional to the vehicle weight.

by Glenn D. Thompson
Environmental Protection Agency, Standards Devel. and
Support Branch, Ann Arbor, Mich. 48105
Rept. No. PB-272 169; LDTP-77-1; 1977
A Technical Support Rept. for Regulatory Action.
Availability: NTIS

HS-022 299

STATE OF NEW JERSEY 1974 ACCIDENT DATA TRAFFIC VOLUMES AND MILEAGE ON THE STATE HIGHWAY SYSTEM BY ROUTE, COUNTY AND MUNICIPALITY

Statistical tables are presented which give 1974 accident traffic volumes, and mileage on the New Jersey Highway system by route, county, and municipality. Statistics are broken down into the following categories: t

highway; average daily volume; two million (million vehicle miles) per year; and number and rates per 100 mv for accidents, injury accidents, fatal accidents, injuries, and fatalities.

New Jersey Dept. of Transportation
1975; 54p
Availability: Corporate author

HS-022 300

NON-METALS TO LIGHTEN YOUR CAR

Fiberglass reinforced plastics (FRP) and graphite fiber reinforced plastic (GrFRP) are used as lighter weight substitutes for metals in automotive parts. Beginning with the all-new 1978 models, there will be a sharp upturn in the use of FRP in an effort to save weight in order to meet new Federal fuel economy standards. Like the almost commonplace front end panels and fender liners made of FRP, most of the new applications for 1978 are functional and many are under the hood or otherwise not readily visible (e.g. distributor caps, fans, belt covers, intake and vent pipes, disc brake pistons). Among the latest high-volume applications is a one-piece steering column housing designed by GM for its mid-size and full-size cars. Some of the other attractive features of FRP besides its lighter weight include corrosion proofness, parts consolidation (replacement of an assembly containing several parts with one made of a single piece), fabrication in complex shapes, orientation of glass fibers in a structure to obtain strength in the direction where it is needed, and less energy required to make a part than with metal. GrFRP can be made quite stiff, making it suitable for use in large flat panels such as hoods, doors, fenders, roofs, and deck lids. Also, its great strength and fatigue resistance allow it to invade areas that were once exclusively the domain of steel (e.g. drivshafts, frames, door guard beams, door hinges). Cost is one of the hurdles that must be cleared before graphite fiber sees widespread usage. High-speed manufacture of GrFRP has not been tried, and there is some question whether it will adequately absorb energy in a collision. FRP, on the other hand, is very cheap and the technology for its production and usage has been perfected.

by John Ethridge
Publ: Motor Trend v30 n2 p61, 64-5 (Feb 1978)
1978
Availability: See publication

HS-022 301

WARRANTY, WARRANTY, WHO'LL PAY MY WARRANTY CLAIM? [CARS, ACCESSORIES, PARTS]

Car and automotive parts warranties are discussed. American Motors, Ford, and General Motors have all greatly simplified the wording in their new-car warranties for 1978, making them both easier to read and to understand. Also, the 1978 versions of AMC, Ford, and GM warranties include an extension of the free-service adjustment period to 12 months or 12,000 miles from 90 days (in the case of Ford and GM) and from four months/4000 miles (AMC). AMC and Ford each also provide for extensions of their standard 12-month/12,000-mile warranty

on used cars have little uniformity. Most parts and accessories purchased through domestic dealers at the time of a car purchase are covered by the same warranty that the manufacturer gives its cars. Replacement parts installed at the dealership are generally covered by a 90-day warranty. Other parts and accessories purchased at parts stores, department stores, etc., will have individual warranties given either by the manufacturer or the supplier. Some cautionary notes with respect to warranties for accessories include the following: never accept a verbal warranty or guarantee, have any papers relating to the warranty signed by the seller, make sure the warranty is still in effect if you are the second purchaser of a product, check the pro-rata replacement policy, and check applicability of limitations in duration of warranty. For a legitimate complaint with regard to a warranty, some or all of the following steps might be successively followed: see if you made your warranty claims as outlined in the owner's manual or warranty booklet; assemble all the relative facts; try again to have the problem rectified through the store or dealer; assuming dissatisfaction from place of purchase, contact the wholesale supplier or distributor (parts) or customer relations department (cars); contact the manufacturer or importer; when all else fails, get outside help (e.g. consumer protection agency); and finally, if a large financial sum is involved, consult an attorney.

by Walt Woron
Publ: Motor Trend v30 n2 p93, 96, 99 (Feb 1978)
1978; 3ref
Availability: See publication

HS-022 302

UNIFORM TIRE QUALITY GRADING: END OF THE TIRE BUYER'S DILEMMA?

The National Hwy. Traffic Safety Administration's (NHTSA) proposed Uniform Tire Quality Grading (UTQG) standards are based upon three values: tread wear, traction, and temperature resistance. They would provide a system to assist consumers in making a more informed selection in the purchase of motor vehicle tires. Controversy is raging, though, between the tire industry and NHTSA, at the center of which is the method of evaluating tread wear. NHTSA has established a UTQG test center in an area of San Angelo, Tex. and the heart of the wear test is a 7200-mile drive over specific loops of highways around San Angelo. Tire loads and speeds are rigidly controlled, and tread wear is monitored during the whole course of the test. The base standard for the tests is a CMT (Course Monitor Tire) which is run along with the group of tires under test. The CMT is supposed to have a statistical variation of 5% or less, but the Rubber Manufacturers Assoc. refutes this claim. The tire industry also points out that there can be variations in tires made consecutively on the same machinery by the same crew and that wear grading obtained driving mostly 55 mph, as it is by UTQG procedures, will usually differ substantially at a different speed. Even if all questions concerning the validity of the grading system are resolved, a fair amount of education and discretion of the part of the consumer will still be required to make the proper choice of tires.

by John Ethridge
Publ: Motor Trend v30 n2 p38-41 (Feb 1978)
1978
Availability: See publication

HS-022 303

THE USE OF TIME SERIES ANALYSIS AND INTERVENTION ANALYSIS TO ASSESS THE EFFECTS OF EXTERNAL FACTORS ON TRAFFIC INDICES: A CASE STUDY OF THE EFFECTS OF THE SPEED LIMIT REDUCTION AND ENERGY CRISIS IN THE STATE OF TEXAS

Time series analysis and intervention analysis were applied to a study of traffic indices for the State of Texas. First, the analysis of time series data espoused by G. E. P. Box and G. M. Jenkins was introduced and motivated within the context of time series data collected on traffic indices. Then, simple models were developed for a set of six traffic indices collected for Texas (monthly vehicle miles in units of 100 million vehicle miles (100 mvm), monthly fatality rate (number of fatalities divided by the 100 mvm driven), monthly fatal accident rate (number of fatal accidents divided by 100 mvm driven), monthly injury rate (number of injuries per 100 mvm driven), monthly injury accident rate (number of accidents involving injury per 100 mvm driven), and a monthly severity index (fatalities/injuries) during the period Jan 1968-Dec 1975. During the time period spanned by these series two significant events occurred. A fuel shortage was experienced in the months of Feb and Mar 1974, and in Feb of 1974 the maximum speed limit on all roads in the state was lowered to 55 mph. Using the methods of intervention analysis developed by G. E. P. Box and G. Tiao, the magnitude of the effects of these two factors on the traffic indices in the state was assessed. The combined effect of the fuel shortage and the speed limit reduction induced significant shifts in the course of the traffic series and the effects of the speed limit reduction have persisted but are diminishing over time.

by John J. Wiorkowski; Robert F. Heckard
Grant NSF-MPS74-06945
Publ: Accident Analysis and Prevention v9 p229-47 (1977)
1977; 10refs
Availability: See publication

HS-022 304

QUESTIONNAIRE RESPONSE BIAS AS A FUNCTION OF RESPONDENT ANONYMITY

Six hundred and ninety-two California drivers enrolled in various driver improvement treatment groups were compared on four primary criteria to evaluate whether the anonymity/nonanonymity condition or group/individual setting had any influence on the nature of responses to questionnaires dealing with the California Dept. of Motor Vehicles' (DMV) driver improvement techniques. The following four criteria were used: open response length (indicates the length of responses on the "comments or suggestions" items given at the end of the questionnaire), open response valence (indicates whether the responses on the "comments or suggestions" section were positive, neutral, or negative), negative valence (indicates negative reactions to forced-choice questionnaire items), and strong feelings (indicates the subject's response to a questionnaire item relating to having strong feelings during the meeting or hearing). Subjects in the anonymous condition gave significantly more positive comments on forced-choice questions. Subjects in the group setting did not respond to the questionnaire as frequently as subjects in the individual hearings. Subjects in the group setting emitted shorter responses and more negative responses than did subjects in the individual hearing

setting. There was no interaction between type of setting and anonymity which suggests that anonymity is not a prior factor when collecting the types of information represented in this study. However, caution must be exercised in generalizing this finding to other types of information and situations, particularly where the data are of a personal or sensitive nature.

by William V. Epperson; Raymond C. Peck
Publ: Accident Analysis and Prevention v9 p249-56 (1977); 6refs
Availability: See publication

HS-022 305

CALCULATION OF HAZARD INDICES FOR HIGHWAY-RAILWAY CROSSINGS IN CANADA

In an effort to aid the Railway Grade Crossing Fund, Canadian Railway Transport Com., Canadian Transport Commission, in selecting hazardous railway crossings to be improved, determining what type of improvements should be applied, and a method for calculating hazard indices for highway crossings was developed. The theory behind and the application of a mathematical model for deriving the distribution of future accidents at a particular railroad crossing by several crossing characteristics are discussed. The makes full use of the Poisson nature of the accident distribution. Calculations can be achieved by means of iterating regression programs. The disaggregated nature of the model allows for the simultaneous analysis of a large number of crossings; this feature, which allows for great flexibility as to other features of the crossings become available, is also possible with aggregated models, due to the problem of small cells. The model presented herein also makes much more complete use of the data than an aggregated model. The model has good predictive ability, and many of the explanatory variables are under partial or full control of the Railway Transport Com. The model has been used to calculate a hazard index for every highway-railway crossing in Canada. These crossings have been partitioned into several groups depending on the size of their hazard indices. The groupings of the crossings with the highest indices will be studied more in detail and priority will be given to these crossings for allocation of funds for crossing improvements.

by D. A. Zalinger; B. A. Rogers; H. P. Johri
Publ: Accident Analysis and Prevention v9 p257-73 (1977); 6refs
Sponsored by Canadian Transport Commission.
Availability: See publication

HS-022 306

ACCIDENT INVOLVEMENT AND CRASH INJURY RATES: AN INVESTIGATION BY MAKE, MODEL, AND YEAR OF CAR

Accident involvement and crash injury rates per million of vehicle travel were estimated by make, model, and year of car. The accident and injury information was obtained from the North Carolina accident files, while exposure data were derived from paired odometer readings recorded on a wide sample of motor vehicle inspection receipts. The data indicate that estimates show a steady decrease in annual mileage per vehicle age. For the newer model years (post 1970), light trucks have generally higher annual mileages than small cars, and station wagons higher mileages than sedans and hardtops.

large-size trucks than four-door cars, and hardtops higher than sedans or station wagons. The exposure period for this study extended from Oct 1973 to Oct 1974, during the "energy crisis." A follow-up study is currently under way based on data derived from a post-energy crisis period, Dec 1974 to Dec 1975, which should give a good picture of the increased vehicle miles of travel (VMT) since the original crisis period.

by Amitabh K. Dutt; Donald W. Reinfurt; Jane C. Stutts
Contract DOT-HS-4-00897
Publ: Accident Analysis and Prevention v9 p275-83 (1977)
1977; 4refs
Availability: See publication

HS-022 307

AN APPLICATION OF SYSTEM FLOW MODELS TO THE ANALYSIS OF HIGHWAY SAFETY DEMONSTRATION PROJECTS

An approach, based on system flow modeling concepts, that has been used successfully by the National Hwy. Traffic Safety Administration (NHTSA) to measure the operating characteristics of traffic safety demonstration projects prior to their implementation and to estimate their impact, is described. These demonstration projects can be viewed as networks through which individuals flow, are processed, receive treatments, and then enter into the general population with assumed recidivism rates. Project personnel requirements, costs, and time information are calculated for an initial base case and compared to test case variations being investigated by traffic safety planners. The computer system is interactive via a terminal and enables planners to determine, in addition to cost and resource requirements, project sample size and results of data sensitivity analysis. An application to a driving while intoxicated probation demonstration project is described.

by Saul I. Gass; Nancy A. David; Paul Levy
Contract DOT-HS-5-01258
Publ: Accident Analysis and Prevention v9 p285-302 (1977)
1977; 2refs
Availability: See publication

HS-022 308

THE 55 MPH LIMITS AND FRONT-TO-REAR COLLISIONS INVOLVING AUTOS AND LARGE TRUCKS

The effects of the establishment of the 55 mph limit on front-to-rear crashes involving automobiles and large trucks were examined, since the establishment of the 55 mph limit has resulted in a reduction in the difference between the reported average speed of automobiles and large trucks. In 1974, the year of the introduction of the 55 mph limit, a substantial reduction in the number of front-to-rear crashes involving a car and tractor-trailer and those involving a car and single body truck on higher speed roads occurred in the states which were examined (North Carolina, Maryland, Pennsylvania, and Texas), primarily as the result of a major decline in the number of crashes in which a car struck a tractor-trailer in the rear. The number of crashes in which a tractor-trailer struck an auto in the rear declined by a much smaller percentage. The

rear in more than half of the front-to-rear crashes involving these vehicles on both higher and lower speed roads. Because the major decline in the number of crashes in which autos struck tractor-trailers in the rear following the introduction of the 55 mph limit was not matched by as large a decline in the number of crashes in which tractor trailers struck autos in the rear, there was a significant increase in the proportion of front-to-rear crashes in which the tractor-trailer struck the car in the rear on higher speed roads. Prior to the 55 mph limit, single body trucks struck cars in the rear in more than half of the front-to-rear crashes involving these vehicles on both higher and lower speed roads. However, single body trucks struck autos in the rear in a lower proportion of their crashes than did tractor-trailers. The proportion of front-to-rear crashes in which an auto was struck in the rear by a single body truck was not significantly affected by the establishment of the 55 mph speed limit.

by Loren A. Zaremba; Marvin J. Ginsburg
Publ: Accident Analysis and Prevention v9 p303-14 (1977)
1977; 28refs
Availability: See publication

HS-022 309

HOW TO MAKE A PASS (PASSING ON THE ROAD)

Some points for the driver (driving in a vehicle with the steering mechanism on the right side) to consider in attempting to pass another car on the highway are discussed. At a distance of 500 meters, most drivers cannot tell the difference between a car moving directly toward them at 50 km/h and one approaching at 100 km/h. Mistakes in passing account for up to 10% of the accidents on rural roads. As a car moves toward you, it appears to be getting bigger. Your eyes and brain measure the rate of expansion and estimate how fast the object is approaching. But at a distance, such as 500 meters, the image of an approaching vehicle does not expand very fast, so your brain has a difficult time estimating the object's speed. Observation of cars passing on the highway reveals that 10%-20% of the drivers leave themselves a safety margin of less than two seconds. The experienced driver has less trouble with passing because passing judgment relies so heavily on experience. It is advisable to slow down and give the chance-taking passer plenty of room in front of you, particularly if you are following another vehicle. Some steps to take in passing include the following: check the road ahead and decide that you have enough clear distance; check behind to make sure that another car is not gaining and ready to pass you; if the road is clear ahead and behind, move up to a safe following distance behind the car ahead; turn on your right turn signal and move over into the right lane; accelerate; make sure the other driver knows you are passing by tapping lightly on your horn or flicking your bright lights; after moving ahead of the other vehicle, flip on your left turn signal; move back into the left lane as soon as you can see all of the passed vehicle in your inside rearview mirror; and cancel your signal and resume normal speed.

Publ: Robot n86 p16-9 (May-Jun 1976)
1976
Availability: See publication

HS-022 310

HS-022 310

EYE FIXATION AND ATTENTION AS MODIFIERS OF PERCEIVED DISTANCE

Head-motion procedures were used to measure the effect of eye fixation and attention upon the apparent distance of a point of light in two clinical experiments. An error in the perceived distance of a physically stationary object results in an apparent horizontal motion of the object if the head is moved horizontally. Procedures have been developed to use this apparent motion to measure the apparent distance of the object. Research has also indicated that the apparent distance of an object will tend to be displaced toward the distance at which the eyes are fixed. In the study reported herein, substantial errors in perceived distance occurred in the predicted direction as a function of fixation distance. Attending to an object at a distance other than the distance of the fixated point of light had much less effect upon the apparent distance of the point. The apparent concomitant motion which occurs in a variety of situations as a function of the distance of fixation indicates that substantial errors in perceived distance are common in most environments.

by Walter C. Gogel; Jerome D. Tietz

Grant PHS-MH-15651

Publ: Perceptual and Motor Skills v45 p343-62 (1977)

1977; 10refs

Availability: See publication

HS-022 311

LET'S LOOK BEFORE WE LEAP: THE COGNITIVE AND BEHAVIORAL EVALUATION OF A UNIVERSITY ALCOHOL EDUCATION PROGRAM

A pilot study was undertaken to evaluate a student alcohol awareness program before its campus-wide introduction at Indiana Univ., since some recent reports have indicated increased drug experimentation following drug-alcohol educational programs. The results of the pilot study appear to validate other reports which have suggested that an increase in knowledge does not necessarily change behavior and supports other investigations which appear to indicate that educational methodologies which have been shown to be effective in some situations may not be effective in other situations. The alcohol awareness program which included a film, values clarification exercises, and discussion significantly increased the students' knowledge about alcohol as measured by a Student Alcohol Questionnaire but had no effect on reported drinking-related behaviors. Since the students reported enjoying participating in the program, since the program did increase the students' knowledge of alcohol and apparently did not induce an increase in negative drinking-related behaviors, the task force that developed the program decided to release it for campus use. It is recommended, however, that if a program just indicates an increase in knowledge but no change in behavior that the presenting group thoroughly discuss its continuation. It is also recommended that longitudinal studies be carried out using a variety of educational methods at every grade level to determine the effect on behavior change in a variety of areas including substance use and abuse. Most importantly, it is recommended that rather than hurriedly developing education programs to meet "crisis situations," that continued, thoroughly evaluated, comprehensive substance use and abuse

education be instituted in the schools from ki through adult education.

by Ruth C. Engs

Publ: Journal of Alcohol and Drug Education v22 n2 (1977)

1977; 20refs

Availability: See publication

HS-022 312

AUTOMOBILE FUEL ECONOMY ON FIXED DRIVING SCHEDULES

Fuel economies measured on various fixed urban schedules (Society of Automotive Engineers urban Motors city-suburban, and Environmental Protection Agency LA-4) as well as the differences in values between individual schedules were analyzed in terms of a simple method of estimating and comparing urban fuel economies of different vehicles has been by using fixed driving schedules. In these schedules, each vehicle the same speed-time history which was defined with respect to representing driving in some type of urban/suburban. The fixed driving schedule approach has the advantage that the effects due to individual and collective driver which are variable in actual traffic, are kept the same for all vehicles run on the schedule. Although the different schedules rank the fuel economies of different vehicles in a consistent way, the actual measured urban fuel economy of a particular vehicle depends systematically on which driving schedule is chosen. The model presented herein, which expresses fuel consumption as a linear function of trip distance derived by driving instrumented vehicles in actual traffic. It was found that there is agreement of fuel economy measurements using fixed urban driving schedules with which supports the view that the fixed urban driving schedules contain speed-time characteristics appropriate for the speed, i.e. each schedule provides an effective representation of traffic-related factors that influence fuel consumption in urban traffic with the same average speed and average speed of the schedule.

by Leonard Evans; Robert Herman

General Motors Res. Labs., Traffic Science Dept., Warrendale, Mich. 48090

Rept. No. GMR-2453; 1977; 26p 14refs

Availability: Corporate author

HS-022 313

INTERNATIONAL SYMPOSIUM ON ALCOHOL FUEL TECHNOLOGY: METHANOL AND ETHANOL, WOLFSBURG, NOVEMBER 21-23, 1977. PROCEEDINGS, VOL. I

A compilation of abstracts of papers presented at an international symposium on methanol and ethanol fuel technology. The following topics were covered during the symposium: the international situation in the area of alcohol technology, economic and political aspects of the production of alcohols in automobiles; the use of methanol and ethanol in automobiles in their neat form and also as alcohol blends or in dual-fuels operation (alcohol and gasoline fuel); the production of methanol and ethanol from natural gas; the optimization of alcohol fuels with a view to economy,

Volkswagenwerk A.G., 3180 Wolfsburg 1, West Germany
1977; 110p
German and English text. Vol. 2 is HS-022 314, Vol. 3 is HS-022 329.
Availability: Dr. W. Bernhardt, Volkswagenwerk A.G.,
Forschung und Entwicklung, 3180 Wolfsburg 1, Federal
Republic of Germany, certified check or money order to
"Methanol and Ethanol Symposium" \$50.00

HS-022 314

INTERNATIONAL SYMPOSIUM ON ALCOHOL FUEL TECHNOLOGY: METHANOL AND ETHANOL. WOLFSBURG, NOVEMBER 21-23, 1977. PROCEEDINGS, VOL. 2

A compilation of papers presented during Sessions 1-4 of an international symposium on methanol and ethanol fuel technology held in Wolfsburg, West Germany during the period 21-23 Nov 1977, is presented. The symposium was organized by Volkswagenwerk A.G. (West Germany) in cooperation with the German Federal Ministry for Research and Technology (BMFT) and the City of Wolfsburg. The topics of the first four sessions of this meeting were as follows: international situation, economic and political aspects; automotive alcohol fuel application (Sessions 2 and 4); and production of methanol and methyl fuel. (Some of the papers are in English, some in German.)

Volkswagenwerk A.G., 3180 Wolfsburg 1, West Germany
1977; 186p refs
Includes HS-022 315--HS-022 328. Vol. 1 is HS-022 313 and Vol. 3 is HS-022 329.
Availability: Dr. W. Bernhardt, Volkswagenwerk A.G.,
Forschung und Entwicklung, 3180 Wolfsburg 1, Federal
Republic of Germany, certified check or money order to
"Methanol and Ethanol Symposium" \$50.00

HS-022 315

METHANOL SUPPLY TO A SWEDISH MOTOR FUEL MARKET

Reasons for Sweden to consider introduction of synthetic motor fuels into the domestic automotive fuel market in an effort to reduce the dependence on petroleum-based fuels are discussed. Approximately 70% of the net energy supply to the Swedish market comes from imported oil and oil products; the most critical sector in the Swedish energy system is transportation, where the dependence on oil is over 97%. Security in supply, the long-range outlook, and supply also in emergency situations play important roles in considering synthetic motor fuels for the future. Routes to producing synthetic fuels are discussed briefly and include the following: hydrogenation of low hydrogen solids to oils with hydrogen/carbon ratio of approximately 1.7-2/1; synthesis of methanol (with some higher alcohols) or of hydrocarbons (with some oxygen-containing compounds; Fischer-Tropsch synthesis) from CO (carbon monoxide)/H₂ (hydrogen) mixtures obtained by gasification) and biological conversion, by hydrolysis and fermentation of cellulose materials to ethanol. Alternatives for production of methanol from various feedstocks such as natural gas, residual oils, coal and indigenous feedstocks such as wood, peat, shale, and refuse are discussed, including the availability and cost of the feedstocks. Wood is traditionally the reserve fuel for both

consumption during normal times. Syngas production from gas, oil, and coal is known technology, but new developments are required for wood, peat, and similar substances. Figures on investment costs and production costs for methanol from recent studies are given.

by Lars Bern; Ake Brandberg
Swedish Methanol Devel. Co., Banergatan 10, 6 tr, S-115 22
Stockholm, Sweden
Publ: HS-022 314, "International Symposium on Alcohol Fuel
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HS-022 316

U.S. ALTERNATIVES TO MOTOR GASOLINE: METHANOL OR SYNTHETIC GASOLINE

U.S. gasoline consumption trends and forecasts to the year 2000 are reviewed; and the merits, in economic terms, of methanol and gasoline from synthetic crudes as replacement fuels are evaluated. It is estimated that gasoline consumption by the year 2000 will be about 8.5 to 9 million barrels per day which is 1.5 to 2 million barrels over the daily consumption of 1976 and 15% over the forecast for 1985 gasoline consumption. Methanol and synthetic gasoline seem to be the synthetic fuels which should be considered as practical replacements for petroleum gasoline during the next 25 years. Raw materials should be coal and oil shale. The price at the plant of methanol produced in quantities of 28,000 tons per day should be in the order of 30.5 cents per gallon, equivalent to \$5.32 per million Btu's. The price of synthetic gasoline should be 72 cents per gallon, equivalent to \$6.37 per million Btu's. Therefore, the price per million Btu's of methanol, excluding excise taxes, would be 15% lower than synthetic gasoline. This is contrary to results quoted by other sources. Synthetic gasoline from coal at the service station will cost approximately the same per million Btu's as methanol. Blends will make better economic sense and will cause fewer problems than the use of unmixed synthetic fuels. When the cost of equipment modifications and fuel efficiency are accounted for, the cost to the consumer for synthetic gasoline and 15% blends is about 15% less than for unmixed methanol and methanol blends. Large-scale production facilities for synthetic fuels would require eight years lead time before commencement of production. The magnitude of the required capital investments (almost \$2 billion) would discourage U.S. industry from undertaking the production of synthetic fuels without economic incentives from the government and guarantees based on firm and predictable government energy policies.

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Results of road tests using an unleaded automotive fuel blend containing 10% anhydrous ethanol (GASOHOL) in the vehicles are reported. On 23 Dec 1974 a 2 million mile (3.2 million km) road test program involving 45 Nebraska-owned vehicles was begun to compare GASOHOL with regular grade unleaded gasoline. Odometer reading and quantity of fuel added were recorded at each fueling stop. Spark plugs were examined and compression measurements were made periodically. The engine heads were also removed from ten cars, the valves and valve seats examined, and micrometer measurements of the cylinder diameter were made. No unusual wear or deterioration of the engine was found as a result of using the GASOHOL. Standard emissions tests were conducted at Energy Res. and Devel. Administration (ERDA) Energy Res. Center in Bartlesville, Okla. Total emissions from GASOHOL were about 15.7 g/mile lower than from unleaded gasoline. The GASOHOL cars obtained up to 5.3% more miles per gallon and 8.7% more miles per Btu than the cars using the unleaded fuel. In addition, the blending of alcohol with unleaded automotive fuel results in an increased octane number and positive volume change of mixing. The improved volatility of GASOHOL fuel provides added driver satisfaction through easier starting of the vehicle, especially in cold weather.

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HS-022 318

FACTORS THAT IMPROVE THE PERFORMANCE OF AN ETHANOL-DIESEL OIL DUAL-FUEL ENGINE

The results of a comprehensive investigation of factors which affect the performance of an ethanol-diesel oil dual-fuel engine are reported. A single cylinder open combustion chamber diesel engine was converted to the dual-fuel mode of operation by incorporating alcohol induction in the air stream through carburetion. The performance of the engine was evaluated on the basis of the following factors: thermal efficiency, combustion characteristics (viz. ignition delay, peak pressures, rates of pressure rise), emissions of hydrocarbon (HC) and nitrogen oxides (NOx) in the exhaust, and the temperature of the exhaust gases. It was found that dual-fuel operation with ethanol and diesel oil leads to very high air utilization and hence much higher (up to 60% higher) power outputs than can be achieved with diesel operation. Under the operating conditions recommended for pure diesel operation, there is a critical proportion between diesel oil and alcohol for satisfactory performance; if the diesel oil injection is reduced further the performance of the engine deteriorates badly. The timing of the injection of the diesel oil was shown to be a very important factor in dual-fuel operation. Optimized injection timing increases the amount of alcohol that can be used, improves the thermal efficiency, and increases power outputs. Higher compression ratios were found to enable higher substitution of

conventional diesel engines can be easily converted to ethanol-diesel oil dual-fuel engines with a substantial additional benefit in power output; also, the thermal efficiency and exhaust emissions are improved over some ranges of operation.

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HS-022 319

METHANOL AS A SUBSTITUTE FUEL IN THE DIESEL ENGINE

Two approaches have been investigated for utilizing methanol as a substitute fuel in the diesel engine: additives to increase the cetane rating of methanol and a dual-fuel diesel engine. Spark plug ignition of a diesel engine has been successfully investigated as another approach, but the necessary redesigning of the combustion chamber to obtain an ignitable mixture makes it an unlikely general solution. A cetane rating of 35 has been reached by using an additive (Cetono) which is sufficient to run the tested engine with 15:1 compression ratio at an ambient temperature of 25° C. The amount of additive, 20%, makes this solution uneconomical. A heat exchanger using engine coolant improves economy and the influence of ambient temperature is eliminated, but there are considerable installation problems in an in-service truck. Cold starting also causes problems that must be solved. A dual-fuel engine has been developed where a fuel of a high cetane rating is injected into the cylinders, approximately when the piston reaches its top dead center position, and is ignited by compression, then in turn igniting the methanol or other type of fuel which needs assistance in igniting. Trials using additives have shown that methanol also ignites under high load in a supercharged diesel engine and therefore, to avoid spontaneous, uncontrolled ignition, methanol cannot be carried in by the inducted air. Instead, the methanol is injected into the combustion chamber after the diesel fuel in order to avoid the methanol cooling off the charge in the cylinder to a degree which would jeopardize the ignition of the diesel fuel. During cold starting and during the first part of warm running, only diesel fuel is injected. The design calls for a complete and separate diesel fuel system with tank, feed pump, belt-driven injection pump and off-center located injectors. The regular injection system is used for the methanol and must be modified for this purpose. The control systems of the pumps are connected mechanically to each other. Results of testing have shown this dual-fuel engine to have good performance, and low emissions of smoke,

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Availability: In HS-022 314

HS-022 320

DUAL FUELLING THE TRUCK DIESEL WITH METHANOL

An investigation of the extent to which methanol could replace normal diesel fuel in truck-size engines using a dual-fuel system was conducted. It was found that the substitution of diesel fuel by methanol is limited to around 50%, assuming mixture heating is employed and that it can be suitably modulated to avoid either quench or knock under transient conditions. Operation on aspirated methanol was shown to result in a higher part load thermal efficiency and better smoke limited performance. A major problem was the unexpected extension of the ignition delay of the pilot fuel associated with the introduction of the methanol into the air charge. Blending of methanol with the evaporating diesel fuel round each droplet could account for the excessive delay. Also, it is possible that methanol disassociation to carbon monoxide and hydrogen is a contributing cause. Diesels running at constant speed (using the larger turbocharged single-speed industrial engine) offer the better market for dual-fueled with methanol. In the longer term, the best approach to use of methanol in automotive engines is thought to be the development of a methanol engine employing spark ignition at a high compression ratio.

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HS-022 321

METHANOL EFFECTS ON LUBRICATION IN ENGINE WEAR

Results are reported of research to determine the effects of methanol and methanol-gasoline fuel blends on wear and deposit formation in conventional spark ignition engines, and if problems exist, to aid in the development of lubricant additives or differing lubricant formulations to control the deleterious effects of methanol. Based on the initial test results presented herein, it is apparent that pure methanol, at least under certain operating conditions, can result in increased wear in present internal combustion engines using conventional lubricants. While the absolute nature of this increased wear is unknown, apparently corrosive attack plays some part in the increased wear. In addition, in combination with water

needs to be done; in particular, the nature of the increased wear phenomena seen from using methanol must be much more thoroughly investigated. In addition, the conditions under which methanol causes increased deposits and wear must be carefully ascertained, since in examining the results of the field tests using methanol fuels, it appears probable that the increased wear with methanol may diminish as the engine operating temperature is increased. This may be due to the elevated temperatures driving off methanol or methanol combustion by-products. It may also be a more fundamental wear phenomena. Test procedures (ASTM Sequences II-C and V-C) are appended.

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HS-022 322

UTILIZATION OF METHANOL AS AN AUTOMOTIVE FUEL: A REPORT FROM IIEC-2, THE INTER-INDUSTRY EMISSION CONTROL PROGRAM

Three approaches for utilizing methanol as an automotive fuel (in its neat form, as a blend in gasoline, and in a dual-fuel system in which it is added at the carburetor for power enrichment) were investigated. Data are presented on prevaporization experiments and aldehyde emission measurements with neat methanol; on driveability and 80,000 km durability tests with blends; and on performance and durability of a dual-fuel demonstration vehicle. In addition, data are given on the effect of methanol blends on laminated Fiberglass materials used in gasoline storage tanks. The first finding of practical concern was that vaporization of neat methanol to improve startability and driveability reduced the peak power and nitrogen oxides (NOx) benefits associated with the high latent heat of vaporization of methanol. Aldehyde emissions increased using neat methanol and methanol blends compared to using gasoline, but their concentrations were reduced with increased exhaust temperatures. In an 80,000 km test of a 20% alcohol (65% methanol) blend, no significant performance or operating problems were observed; however, motor oil viscosity increased and oil consumption was reduced relative to gasoline. In both chassis dynamometer and consumer driving tests of a car without carburetor adjustments, driveability depreciated with increasing methanol concentration in gasoline. Using a dual-fuel system in an 80,000 km road test, power enrichment with methanol along with normal operation on gasoline gave better acceleration and fuel economy but higher hydrocarbon (HC) emissions from a 9.5 CR, 5.8L engine than from an 8.0 CR, 6.6L engine using gasoline alone in an identical car. Compatibility studies with a Fiberglass laminate in a 10% methanol-gasoline blend showed marked changes in the laminate. According to the tank manufacturer, the changes are probably not beyond acceptable limits for un-

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HS-022 323

THE USE OF A FLOATING METHANOL PLANT TO DEVELOP REMOTE OFFSHORE GAS RESERVES

A technical and economic feasibility study was made of building a methanol plant of 2000-metric-tons-per-day capacity on a used tanker or a new barge as a means of developing gas reserves in remote areas either offshore or onshore near to the sea. The results are based on a study for developing a floating methanol plant offshore Southeast Asia, but with some modifications they are applicable to any remote gas reserve offshore/onshore near to the sea (except areas of severe weather conditions, such as the North Sea). Presented are descriptions of the gas delivery system, a comparison of converting a used tanker with building a new barge, the barge-mounted plant, the transportation requirements and cost, the economics; and the potential uses. The study has shown that the concept of a floating methanol plant is technically feasible. The high cost of converting a used tanker eliminated the economic incentive of the low selling prices of such vessels. The total investment required for the gas delivery system, single point mooring, barge, plant, delivery to the site, working capital, and start-up costs, but excluding the tankers needed to transport the methanol, was estimated to be \$130 million. The cost of the plant and barge was found to be less than a land-based plant and less subject to unforeseen cost increases. The construction time required will be seven months less than for an equivalent land-based plant and will be less subject to unforeseen delays.

by Robert G. Jackson
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Publ: HS-022 314, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 2," Wolfsburg, West Germany, 1977 p3-4(1-6)
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HS-022 324

THE CATALYTIC PRODUCTION AND MECHANISM OF FORMATION OF "METHYL FUEL"

A study was made to learn what environmentally acceptable chemicals could be added to methanol and gasoline that would prevent phase separation. Of the various additives tested, isopropyl alcohol was determined to be the most likely can-

mechanism of catalytic formation of higher alcohols is directed toward normal propyl and isobutyl.

by P. G. Laux
Vulcan Cincinnati, Inc., Cincinnati, Ohio
Publ: HS-022 314, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 2," Wolfsburg, West Germany, 1977 p3-5(1-4)
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HS-022 325

THE EFFECT OF BLENDING METHANOL WITH GASOLINE ON THE LEAN MISFIRE LIMIT OF A MULTICYLINDER CARBURETED ENGINE

A four-cylinder carbureted engine was fueled with Indolene (gasoline) and a blend of Indolene and 20% by volume methanol to determine the effect of the blend on the lean misfire limit (LML). A secondary objective of the study was to make a comparison of the relative merits of several methods of LML detection (mixed hydrocarbon (HC) emission level, leanest-cylinder HC emission level, leanest cylinder blowdown pulse reduced pressure, standard deviation of the leanest-cylinder nondimensional peak pressure, standard deviation of the leanest-cylinder nondimensional blowdown pulse pressure, individual-cylinder equivalence ratio spread, and the counting of audible misfires). The results show a small extension of ignition failure-induced (IFI) LML for the blend. The presence of fuel droplets in the combustion chamber at the time of ignition with methanol and methanol blends is offered as a potential cause of the extended IFI LML found with these fuels. Of the LML detection methods, the counting of motoring cycles as ascertained from in-cylinder pressure transducer measurement, is more sensitive than the monitoring of HC emissions. The sensitivity of counting misfires audible at the exhaust pipe falls between the sensitivities of the motoring cycle and HC monitoring methods. The sensitivity of the standard deviation of the leanest-cylinder blowdown pulse pressure as a LML detector is about the same as the sensitivity of the methods using motoring cycle frequency of occurrence.

by K. A. Chester; R. R. Adt, Jr.; K. T. Rhee; J. M. Pappas; M. R. Swain
University of Miami, Mechanical Engineering Dept.; Hawthorne Res. and Testing, Inc.
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EXHAUST EMISSIONS FOR SIMULATED DRIVING CYCLES WITH METHANOL AND INDOLENE

An experimental program was conducted to determine the relative benefits of operating a vehicle with a 2300 cc, four-cylinder engine on methanol with alternate air-fuel induction systems when compared with OEM equipment operating on Indolene. The following three alternate fuel systems were compared: manifolded open loop electronic fuel injection, manifold shockwave carburetion, and individual cylinder acoustic wave fuel metering. Comparisons of fuel economy and exhaust emissions including aldehydes were achieved by using the dynamometer-mounted steady-state engine test results in conjunction with a computer simulation of the Federal Emissions Test and the Federal Hwy. Fuel Economy Test procedures. Results from the simulation indicate gains in fuel economy on an energy base ranging from 15% to 30% for the alternate fuel preparation systems in comparison to OEM results using Indolene. In addition, operation at a lean equivalence ratio of 0.7 in methanol indicates that Federal statutory emission standard for nitrogen oxides (0.40 g/mile) can be met. One novel fuel-air induction system which eliminates cylinder-to-cylinder variations in equivalence ratio (maldistribution) is described. In addition, a maldistribution index which relates cylinder-to-cylinder variations in equivalence ratio to penalties in power and thermal efficiency is introduced.

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HS-022 327

A COMPARISON OF GASOLINE, METHANOL, AND A METHANOL/WATER BLEND AS SPARK IGNITION ENGINE FUELS

Indolene, methanol, and methanol 05% water (M5W) were tested in a single-cylinder spark ignition engine to determine their influence on power, efficiency, and exhaust emissions. Two compression ratios, two mixture temperature conditions, and two spark advance conditions were tested for air/fuel ratios ranging from 10% rich to 30% lean. Methanol and M5W fuels exhibited efficiency increases of 2%-3% for the range of test conditions. At equal intake mixture temperatures, methanol and M5W produced 5%-7% less power output than Indolene. For constant manifold heat conditions (substantially lower mixture temperatures), methanol and M5W produced 5%-7% more power than Indolene. Peak nitrogen oxides (NOx) emissions were reduced 30%-40% with methanol and 45%-60% with M5W over the Indolene reference fuel. Mass specific carbon monoxide (CO) emissions were essentially unaffected by fuel type. Mass specific emissions of unburned fuel (UBF) were comparable for Indolene and methanol at all test conditions. Indolene, methanol, and M5W exhibited comparable

emissions.

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HS-022 328

STRATIFIED CHARGE IN A SINGLE CHAMBER ENGINE USING METHANOL

A stratified charge by means of direct auxiliary fuel injection has been studied with a single chamber engine as a means of achieving a reduction in nitrogen oxide (NOx) emissions without a great sacrifice in fuel economy. Methanol, because of its lower rate of soot formation in combustion, was utilized; gasoline injection could not be applied in this technique because of spark plug fouling. The spark ignition engine was operated with wide open throttle at engine speed of 1500 rpm, using a special shrouded spark plug as well as a conventional plug. Emissions and engine performance were measured for various injection directions, overall equivalence ratios and injection rates, and for different values of injection ratio and injection timing. Successful stratification was obtained with auxiliary injection of fuel directly to the vicinity of the spark plug. Also the main fuel (methanol) was carbureted. A reduction of over 50% in NOx emissions was attained while maintaining the same thermal efficiency in comparison with nonstratified charge.

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HS-022 329

INTERNATIONAL SYMPOSIUM ON ALCOHOL FUEL TECHNOLOGY: METHANOL AND ETHANOL. WOLFSBURG, NOVEMBER 21-23, 1977. PROCEEDINGS, VOL. 3

The topics of the last four (5-8) sessions of this symposium were as follows: production of ethanol by grain fermentation; ethanol production from manioc; continuous alcoholic fermentation of sugar solutions and mash; energetics and economics of fuel alcohols in Brazil; methanol and petrol carburetion systems in The Netherlands; flash boiling injection in methanol engines; fuel converter for spark ignition internal combustion engines; methanol-water fueled engine performance and emissions; combustion history in methanol

operations; evaporation of methanol droplets impinged upon hot surfaces; blending of gasoline and methanol; methanol in motor gasoline and its impact on oil refining; modifying methanol for highway vehicles; use of methanol fuel as it affects refinery processes; startup and driveability characteristics of methanol fuels; gasoline/methanol fuels in spark ignition engines; methanol and ethanol as raw materials for synthesis of high-octane components; toxicology of alcohol fuel; environmental, health, and safety aspects of methanol and ethanol; and biological effects of methanol spills into marine, estuarine, and freshwater habitats.

Volkswagenwerk A.G., 3180 Wolfsburg 1, West Germany
1977; 163p refs
Includes HS-022 330--HS-022 345. Text in either German or English. Vol. 1 is HS-022 313, Vol. 2 is HS-022 314.
Availability: Dr. W. Bernhardt, Volkswagenwerk A.G., Forschung und Entwicklung, 3180 Wolfsburg 1, Federal Republic of Germany, certified check or money order to "Methanol and Ethanol Symposium" \$50.00

HS-022 330

THE PRODUCTION OF ETHANOL BY THE FERMENTATION OF GRAIN

Processes for producing industrial ethanol from grain and the economics of production in terms of grain type, price, and plant size are considered. Energy requirements for the grain production and fermentation plant are reviewed and new process and engineering developments that would improve plant economics are discussed. An economic evaluation of the profitability of the production of 20 million gallons (75.8 million liters) per year of anhydrous ethanol from 21,490 bushels (546 metric tons) per calendar day of milo (a maize grain) indicates an annual rate of return above 20% on the total investment of \$27,000,000. In larger plants the economic outlook is even more attractive. When both the farming operation and the fermentation process are considered, and with proper use of a portion of the biomass produced, for every three gallons of grain alcohol produced at least one gallon is new energy entering the economy. In contrast, when a similar analysis is made for the production of synthetic ethanol from mixed light gases via ethylene hydration, the energy equivalent of about 1.5 gallons of ethanol is consumed for every gallon produced. Furthermore, between now and 1980 the price of ethanol from ethylene is expected to increase at a considerably greater rate than ethanol from grain.

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HS-022 331

ECONOMICAL AND TECHNICAL ASPECTS OF ETHANOL PRODUCTION FROM MANIOK

Ethanol production is illustrated by a plant with a capacity for producing 200 cu m of ethanol per day which is planned in Mato Grosso, Brazil. Agricultural, sweet mash production, fer-

mentation, distillation, economic vinasse treatment, and energy aspects are considered. A continuous fermentation process is proposed. One of the characteristic process techniques is a continuous circulation of the fermenting mash in such a way that the sweet mash (without yeast) is diluted by a factor of 1:1000 or more. The second characteristic principle of the process is the change of anaerobic and aerobic conditions for the fermenting yeast on a short-time basis. Thus, the oxygen demand for assimilation and anabolic metabolism can be supplied without the disadvantages of the Pasteur effect. Furthermore, the process is characterized by a comparable low pH value which is the result of the coexistence between yeast and lactobacilli. The ethanol yield is higher with the existence of bacteria. Technical implementation of the process is done by the use of air-lift shafts.

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HS-022 332

BASIC DATA ON CONTINUOUS ALCOHOLIC FERMENTATION OF SUGAR SOLUTIONS AND OF MASHES FROM STARCH CONTAINING RAW MATERIALS

Basic data on continuous alcoholic fermentation of sugar solutions and of mashes from starch-containing raw materials show that continuous alcoholic fermentations are preferable over one-stage processes. The specific yield of ethanol (based upon the fermented sugar) can be about 98% of the theoretical value compared to about 93% yield in normal batch processes. Continuous fermentation of enzymatically-saccharified, starch-containing raw materials is limited by the saccharification rate and takes about 40 hours fermentation time. Fermentation of clarified beet or cane juices needs only six hours fermentation time. Scale-up is no problem. The continuous fermentation process does not need sterile conditions because bacteria do not have a chance for considerable growth and because of selective conditions for growing and fermenting yeast.

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HS-022 333

ENERGETICS, ECONOMICS AND PROSPECTS OF FUEL ALCOHOLS IN BRASIL [BRAZIL]

Brazil is one of the few countries in the world which has a combination of resources and needs such that large-scale

alcohol present in the near future since it is based on a well established technology and existing industrial infrastructure. Methanol appears to be of interest in some regions where coal and/or agricultural residues are abundant (such as in Southern Brazil). The major use of alcohol should be in automotive engines, a minor use in utilities. Analysis of cassava and sugar cane ethanol production has shown that, in both cases, a net positive return on energy investment is achieved, considering current Brazilian agricultural and industrial technologies. Presently, the estimated costs (in U.S. dollars) of cassava-ethanol (\$338/cu m and \$363/cu m, with and without electric power generation, respectively) and sugar cane ethanol (\$333/cu m) exceed the price established by the Government (\$290/cu m). Analysis of these costs indicates that feedstock accounts for a substantial share of the total. In addition, these estimated costs rank close to that of gasoline at the station (\$413/cu m), allowing a small margin to cover the costs of alcohol blending and distribution. Thus, in the short term, political decisions can alter the economics of fermentation alcohol; in the medium term, agricultural productivity and industrial yield improvements together with probable increases in the price of petroleum are expected to make fermentation ethanol increasingly more competitive in Brazil.

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HS-022 334

DEVELOPMENT OF METHANOL AND PETROL [GASOLINE] CARBURATION SYSTEMS IN THE NETHERLANDS

Research and development work in The Netherlands regarding methanol/gasoline carburetion systems has been done using methanol without additives to increase its volatility; such additives are necessary, however, for cold start and driveability. First, systems are described which have two fuel tanks and enable the driver to switch electrically from using gasoline to using methanol and back. Next, the state of the art is described of the research and development work of systems which might create the possibility for cars to run on all possible mixtures varying from 0% to 100% methanol. If this type

Combustion engines, P.O. Box 237, Deift, Holland
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HS-022 335

FLASH BOILING INJECTION IMPROVES PERFORMANCE OF METHANOL ENGINES

A new methanol fuel induction method involves a rapid boiling and atomization of superheated fuel under high pressure in the nozzle as soon as it is injected from the nozzle. Droplet size was measured using a direct microphotographic method in the open air, and a single-cylinder engine was tested with the flash boiling technique. It was found that flash boiling spray has very uniform droplet size distribution, and reduces the Sauter mean diameter by half as compared with normal high pressure spray. The thermal efficiency was found to increase and the unburned methanol emission to decrease distinctly by means of flash boiling injection. Also, when flash boiling injection is used in the stratified charge method of cylinder injection with an open combustion chamber, unthrottling operation is possible with lean mixture.

by Hideo Suto; Nobuo Iwai; Takahiro Tsuruga; Yong Kil Kim; Osamu Hirao

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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p6-2(1-6) 1977; 3refs

Presented at the Symposium, Wolfsburg, West Germany, 21-23 Nov 1977. Sponsored by Ministry of International Trade and Industry of Japan.

Availability: In HS-022 329

HS-022 336

FUEL CONVERTER WITH METHANOL FOR SPARK- IGNITION INTERNAL COMBUSTION ENGINE

A hydrogen injection system for internal combustion engines is described which makes it possible to operate on very lean air/fuel (A/F) mixtures. It is well known that a lean air/fuel ratio in a spark ignition engine gives low emissions of carbon monoxide (CO) and oxides of nitrogen (NOx) while maintaining good fuel economy, and that exhaust gas recirculation (EGR) gives lower emissions of NOx. The system involves the production of hydrogen in a catalytic steam-reforming reactor using methanol or gasoline as fuel. Energy is supplied by heat exchange with the exhaust gas. Catalytic studies with nickel catalyst are presented for the special reactant gas composition in the reactor. Theoretical evaluation of the system shows that methanol is an excellent fuel for the reactor. The system permits very lean A/F mixtures with a gain in the fuel consumption and an excellent emission picture. It is possible to drive

the engine with A/F ratios of 1.4 with emissions of 10 ppm NOx.

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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p6-3(1-7)

1977; 22 refs

Presented at the Symposium, Wolfsburg, West Germany, 21-23 Nov 1977. Sponsored by Carl Tryggers Stiftelse for Vetenskaplig Forskning.

Availability: In HS-022 329

HS-022 337

PREDICTED METHANOL-WATER FUELED SI [SPARK IGNITION] ENGINE PERFORMANCE AND EMISSIONS

Compression ratio (CR) and liquid water addition effects on performance and emissions of a methanol-fueled spark ignition engine were studied using a combustion kinetics computer model which incorporated two different cylinder head geometries (flat head and squish chamber). Earlier experimental work by two independent research workers had shown that volumetric nitrogen oxides (NOx) emissions decreased when CR was increased from 9.7:1 to 14:1 at MBT (maximum brake torque) spark settings. The flat head computer model, however, predicted a continual increase in volumetric NOx emissions for increasing CR at MBT spark timing. With only a 3° retard from MBT, the computer-predicted volumetric NOx emissions at 14:1 CR were reduced to those at 8.44:1 CR and MBT spark timing. With this spark retard setting, there was a net increase in power and thermal efficiency of 13.7% relative to the MBT values at 8.44:1 CR. Contrastingly, the squish chamber computer model predicted a drop in volumetric NOx emissions by raising the CR from 8.44:1 to 14:1 at MBT spark timing. This decrease in NOx emissions was due to increased turbulence caused by the changing cylinder head geometry as the CR increased. The effects of adding various percentages of liquid water to methanol were also examined. They showed an 84% reduction in NOx emissions with a slight gain in power and thermal efficiency by using a 30% water/70% methanol mixture instead of 100% methanol at the same equivalence ratio and CR.

by Louis H. Browning; Richard K. Pefley

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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p6-4(1-6)

1977; 11 refs

Presented at the Symposium, Wolfsburg, West Germany, 21-23 Nov 1977. Supported by grants from the Environmental Protection Agency and the Energy Res. and Devel.

Administration.

Availability: In HS-022 329

HS-022 338

EVAPORATION OF METHANOL DROPLETS IMPINGED UPON A HOT SURFACE

Droplets of methanol and its water solution impinged upon a heated metal surface were observed and their lifetimes measured. The experiments were carried out changing the imping-

ing velocity, droplet size, surface material, and methanol concentration. In addition to the two well known points on the lifetime curve for liquids (the minimum lifetime point M at the Leidenfrost point L), a new particular point was found where the lifetime of methanol (and other liquids such as ethanol, propyl-alcohol, and acetone) is discontinuously decreased on a slightly heated surface. This phenomenon is the result of the further extension of methanol film on the surface originated by their hydrogen bonding. This extension requires existence of moisture and polarity of liquid, which means such reduction of lifetime can occur only on polar liquid. A discontinuous decrease of lifetime occurred in the film boiling zone when the impinging velocity exceeded a certain value (between 0.17 m/sec and 3.0 m/sec). Poor thermal diffusivity of surface material extended the minimum lifetime zone. The effect of droplet size was not so remarkable. A water solution of methanol had a fairly wide minimum lifetime range. This might be a strong point when methanol is used as an engine fuel because the flexibility in operating conditions will be improved.

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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p6-6(1-8)

1977; 7 refs

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Availability: In HS-022 329

HS-022 339

GASOLINE-METHANOL FUELS; BLENDING OPTIMISATION WITH RESPECT TO MANUFACTURING ECONOMICS AND ENGINE PERFORMANCE

Gasoline/methanol blends were investigated in laboratory studies of antiknock performance, composition stability, and engine performance parameters as well as in controlled road tests with current and modified cars. The increase in octane quality by use of methanol as a component was found to be the greatest with low octane quality fuel components. It was concluded that the value of methanol as an octane blending component is greatest for the hydroskimming type of refinery and poorest for the conversion type of refinery; the value with respect to a petrochemical refinery lies in between the two. With the components selected for the conversion of petrochemical refineries, the Motor Octane Number (MON) cannot be raised above 88 with the use of methanol, i.e. high speed knock performance could not be improved. No road antiknock bonus was found with methanol-containing fuels compared with conventional fuels of the same Research Octane Number (RON) and MON; this was indicated by testing the fuels in two cars. Low molecular weight aromatics were found to improve the fuel stability more than the high molecular weight aromatics. A useful equation has been developed which can predict the phase separation temperature from the water and low and high molecular weight aromatics, and olefinic components. A further improvement in the predicting equation may be possible by taking into account the different types of olefins. The use of isobutanol was found to improve fuel stability. Cold starting performance can be better predicted by the volatility of the base gasoline rather than by the finished methanol fuel, whereas the driveability performance is controlled by the volatility of the finished methanol-containing

fuel. To ensure acceptable starting and driveability, the front end volatility of the methanol-containing fuel should be at the maximum or even higher than current DIN specification. Vapor lock performance is one of the critical areas with methanol-containing fuels; if special care is taken in designing the car fuel system, such vapor lock problems can be avoided. Finally, it is concluded that analytical test techniques could be altered to enable a better interpretation of the engine performance of methanol-containing fuels by taking into account the energy consumed in a distillation test, or by using a dry bomb technique for the vapor pressure measurement.

by R. W. Hooks; K. H. Reders; A. A. Reglitzky
Deutsche Shell A.G., PAE-Labor, Hamburg, West Germany
Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p7-1(1-8)
1977; 11 refs
Presented at the Symposium, Wolfsburg, West Germany, 21-23 Nov 1977. Supported in part by the German Federal Ministry for Res. and Technology.
Availability: In HS-022 329

HS-022 340

METHANOL IN MOTOR GASOLINE--IMPACT ON OIL REFINING

The effects on oil refinery operations of blending methanol with gasoline are considered for hydroskimming and catalytic cracking refineries. When methanol is included a greater production of gasoline is possible, with significant improvements in quality; alternatively, with constant gasoline production, crude consumption is reduced. Catalytic reformer throughput and operating severity are reduced. Some reformulation is necessary, mainly to overcome the increase in volatility. Research Octane Number (RON) and RON100 C° are increased while benzene content and MON (Motor Octane Number) are decreased. Although the methanol blends considered meet the normal quality specifications, no account has been taken of the problems of water tolerance, increased fuel consumption, and changes of specification which may be necessary to ensure adequate road performance. Economics was also not considered.

by E. H. Spencer
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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p7-2(1-7)
1977; 4 refs
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Availability: In HS-022 329

HS-022 341

MODIFICATION OF METHANOL FUEL FOR HIGHWAY VEHICLES

An on-going study being conducted for the Energy Res. and Dev. Administration (ERDA) on the modification of methanol fuel for highway vehicles covers methanol use both in blends with gasoline and alone or in fuels where it is the major component. Bench scale tests used to study cold startability, warm-up driveability, and vapor locking characteristics are described. Results of studies of various fuel modifications

designed to overcome problems with water contamination, cold starting, and vapor lock are presented. Difficult starting in cold weather is a major problem with neat methanol that can be avoided by incorporating 5%-25% of selected hydrocarbons or gasoline. With proper choice of the amount and type of cold starting additive, the tendency to vapor lock is not increased unduly, the vapor in tanks is rendered nonexplosive, the flames of any fire are more visible, and the risks of harm from methanol toxicity are decreased. However, satisfactory driveability in carbureted cars with fuel that is mostly methanol would require modification of the carburetor and induction system unless the methanol were largely converted to other chemical species such as hydrocarbons. With blends of methanol in gasoline the major problem of phase separation at low temperatures or in the presence of water can be greatly alleviated by adding higher alcohols as cosolvents. Alcohols producible with methanol from synthesis gas are suitable. Some modification of fuel distribution equipment would still be required to limit entry of water. Mixing of blends with straight gasoline should be avoided to prevent phase separation caused by fuel incompatibility. The increased tendency to vapor lock which accompanies addition of methanol to gasoline could be controlled by withholding butane, but more fuel energy would be lost than gained. Replacing part of the methanol with higher alcohols in order to improve water tolerance would also diminish the vapor locking tendency enough to permit net gain in energy. Conversion of methanol to ethers by reaction with olefins appears to eliminate many of the technical problems with blends in gasoline, but any increase in the gasoline supply this way would be severely limited by olefin availability.

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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p7-3(1-8)
1977; 28 refs
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Availability: In HS-022 329

HS-022 342

THE EFFECT OF THE USE OF METHANOL AS ENGINE FUEL ON THE REFINERY PROCESS SCHEMES

Studies on the effect of the use of methanol as a high octane component of automotive engine fuels on the Italian refining industry were conducted using a linear programming model of the Italian refining industry, to optimize the production of a premium grade of gasoline according to the three most common refining schemes currently employed (topping and catalytic reforming; topping, catalytic reforming and isomerization; and topping, catalytic reforming, catalytic cracking, and alkylation). The composition and characteristics of the fuels relative to each scheme are presented. A blending study was also conducted in order to determine the concentration of methanol required for the production of premium fuels having a Research Octane Number (RON) of 98-99, no volatility limits, a lead (Pb) content between 0.0 and 0.40 g/l maximum allowed vapor pressure, and complete miscibility at least in the anhydrous state. The effect of imposing the volatility limits of the present commercial gasolines on the production of the finished blends was also considered. It was concluded that if no volatility limits are imposed, the use of methanol (at least

at a concentration of 15%-20%) appears to be an interesting solution for the Italian refining industry (also in view of the lead content reduction resulting from the use of methanol). Also, if volatility limits, besides the Reid vapor pressure (RVP), are enforced on blends, the use of methanol will obviously be dependent on the specification values.

by G. Pecci; P. Garibaldi
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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p7-4(1-8)
1977; 3refs
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Availability: In HS-022 329

HS-022 343

METHANOL AND ETHANOL AS RAW MATERIALS FOR THE SYNTHESIS OF HIGH OCTANE COMPONENTS

The chemical, physical, and knock characteristics of ether/gasoline blends are discussed. Considering the problems which have still to be solved before the direct utilization of alcohols as alternative automotive fuels, the use of methanol and ethanol as raw materials for the synthesis of methyl-tert-butyl ether (MTBE) and ethyl-tert-butyl ether (ETBE) seems extremely promising. These ethers, having a high blending Octane Number (ON), are not associated with any of the problems typical of the alcohols/gasoline mixtures (water solubility, formation of azeotropic mixtures, high heat of evaporation, corrosion, etc.). Presented are performance and emission results obtained in engine bench and vehicle road tests, using fuel blends containing up to 20% ether. Also, the process of manufacturing the two ethers starting from methanol or ethanol and isobutylene is described; based on present availability of isobutylene, the theoretical production capacity of MTBE and ETBE in the industrialized countries has been assessed. MTBE shows the following differences when compared to methanol: blending Research Octane Number (RON) slightly lower, but blending Motor Octane Number (MON) higher and as a consequence similar (RON/MON)/2 values; no problem in the blends formulation and distribution owing to the lack of azeotropes formation with hydrocarbons and to the absence of water tolerance problems; no cold starting problems since MTBE heat of vaporization is similar to the value for hydrocarbons; and higher heat content per volume. Similar observations also apply, in general, to ETBE in comparison with ethanol. Therefore, the use of ethers appears to be very promising; it is also possible that they may be applied immediately without any modifications to the present vehicles and/or to the refining process. Moreover, increasing amounts of isobutylene shall be available in the near future owing to the worldwide trend to use virgin naphtha and heavier fractions as ethylene plant feedstocks.

by P. Garibaldi; G. Pecci; F. Vicenzetto; S. Razzi
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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p7-7(1-9)
1977; 3refs
Presented at the Symposium, Wolfsburg, West Germany, 21-23 Nov 1977.
Availability: In HS-022 329

HS-022 344

METHANOL AND ETHANOL FUELS--ENVIRONMENTAL, HEALTH AND SAFETY ISSUES

Research needs required to ensure that the distribution and utilization of methanol and ethanol fuels will be acceptable with respect to the environment, health and safety are addressed. Research in the utilization of alcohol fuels for transportation has progressed to the point where the impact on society can be characterized as the utilization technology develops. The major part of the discussion presented concerns the identification of the environmental, health and safety issues; the remainder is a description of the physical/chemical properties of methanol and ethanol as they may relate to these issues and a presentation of recommendations for parallel research efforts. The bulk of currently available information and contemporary research regarding alcohols as motor fuels is centered around the characterization and measurement of emissions, fuel economy and performance. Emission characterization should also include the effects of any fuel additives used as odorants, flame colorants, or emetics. Limited efforts have been applied to studying the effects of handling methanol in an industrial environment (namely, acute exposure and accidental ingestion). However, a data void exists in the areas that characterize environmental and health effects on the general public, especially the effects of chronic, low-level exposure to methanol or ethanol. There is a need for developing a data base to identify and predict adverse environmental, health and safety impacts of methanol/ethanol as automotive fuels. Research efforts are recommended for the following areas: development of reliable, standardized instrumentation and test techniques to measure aldehydes present in the exhaust of engines fueled with alcohols; photochemical reactivity and product formation of alcohol-fueled engine emissions, and atmospheric modeling to predict the impact of widespread alcohol fuels use; identification of the required technology for developing cleansing mechanisms in the event of methanol or ethanol spills on land or in water; investigation of the impacts associated with low-level, chronic releases of alcohol fuels (particularly methanol) into terrestrial and aquatic ecosystems; estimation of the exposure levels to alcohol vapors in tunnels and transportation facilities such as retail dispensing outlets, and under a wide range of adverse conditions; determination of the health effects that result from chronic, low-level exposure; identification of precautions beyond those taken to minimize vapor loss for the general public's protection against skin absorption during fuel handling and dispensing; and development of fuel tanks and other storage containers that minimize explosion and fire hazards.

by Graham Hagey; Andrew J. Parker, Jr.; Daniel L. Raley; Thomas J. Timbario
Department of Energy, Office of the Assistant Secretary for Environment, 20 Massachusetts Ave., N.W., Washington, D.C. 20545; Mueller Associates, Inc., 1900 Sulphur Spring Rd., Baltimore, Md. 21227
Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol, Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p8-2(1-23)
1977; 13refs
Presented at the Symposium, Wolfsburg, West Germany, 21-23 Nov 1977.
Availability: In HS-022 329

HS-022 345

BIOLOGICAL EFFECTS OF METHANOL SPILLS INTO MARINE, ESTUARINE, AND FRESHWATER HABITATS

Investigations of the biological consequences of methanol spills or leaks into the aquatic ecosystems indicate that many organisms are tolerant of low concentrations. Data on tolerance (LD50, 15° C, percentage, time) to methanol, and physiological impact of methanol (ciliary narcosis, cardiac arrhythmia, disruption in gametogenesis, disruption in molting) for 42 genera are tabulated. Current assessment of methanol toxicity to small aquatic organisms suggests that the effects of one-time spills or leaks would probably be minimal, except in proximal areas where concentrations reach or exceed 1%. Since low levels of methanol occur naturally in many stable habitats, and as methanol is generally quite miscible, volatile, and degradable, gross environmental impact from moderate spills appears unlikely. Gasoline and related fuels are much more toxic and lead to more irreversible effects than methanol in comparable concentrations.

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Publ: HS-022 329, "International Symposium on Alcohol Fuel Technology: Methanol and Ethanol. Proceedings, Vol. 3," Wolfsburg, West Germany, 1977 p8-3(1-3)

1977; 3refs

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Availability: 1n HS-022 329

HS-022 346

ATTITUDES REGARDING ALCOHOLISM AMONG A GROUP OF DRINKING DRIVERS. RESEARCH NOTE [BOSTON, MASSACHUSETTS, ALCOHOL SAFETY ACTION PROJECT]

Ninety-four drinking drivers were surveyed in a 40-statement questionnaire to determine their attitudes toward alcoholism. Of nine assessment factors compared with a general population norm group, two were found to be different for the drinking drivers. The norm group was ambivalent, while the drinking drivers were positive, in the beliefs that periodic excessive drinkers can be alcoholic, and that the alcoholic is not a harmless drinker whose drinking is motivated only by his fondness for alcohol. Conversely, the norm group was positive and the drinking drivers ambivalent in the belief that emotional difficulties and psychological problems can contribute to alcoholism. The drinking driver appears to be conflicted about several issues related to alcoholism, being undecided about alcoholism as an illness and alcohol as an addictive substance. The results of the study suggest possible changes in emphasis to be made in the teaching programs for the Alcohol Safety Action Projects.

by Larry Hart

Contract DOT-HS-075-1-098

Publ: International Journal of the Addictions v12 n2/3 p411-5 (1977)

1977; 6refs

Availability: See publication

HS-022 347

EYE MOVEMENTS WHILE DRIVING CARS AROUND CURVES

The eye fixations of five experienced and four inexperienced car drivers were analyzed while driving curves to the left and right. The eye movements were registered with a NAC III Eye-Marc-Recorder connected to an Akai-videorecorder within a visual field of 30° and played on a Grundig-Slow Motion-Apparatus, with each single frame corresponding to an observation interval of 20 msec. For experienced drivers in a curve to the left the mean duration of eye fixations was longer and the amplitude of the eye movements greater than in a curve to the right. No such difference was observed in inexperienced drivers who manifested neither uniformity within the same curves nor differentiation between the two types of curves. Mean duration of eye fixations of experienced subjects was shorter while driving in a curve to right, but their amplitude of eye movement was greater in a curve to left than those of inexperienced drivers. When eye movements were recorded for the same subjects approaching a curve to the right, the inexperienced drivers, even after more than a year of driving, did not show any differentiation between curves or any significant individual differences, as did the experienced drivers. It is therefore suggested that acquisition of driving skills is a long term process. With increasing practice, the driver appears to establish better strategies for recognizing essential information and identifying relevant clues to direct his responses.

by Amos S. Cohen; Herbert Studach

Grant 4.50.71-FKG

Publ: Perceptual and Motor Skills n44 p683-9 (1977)

1977; 10refs

Also supported by a grant from Swiss Foundation of Rd. Accident Prevention.

Availability: See publication

HS-022 348

DRIVERS IN ALBERTA WITH PREVIOUS IMPAIRED DRIVING RECORDS RESPONSIBLE FOR FATAL HIGHWAY ACCIDENTS: A SURVEY, 1970-1972

Sixty-four variables were coded for each person killed in a motor vehicle crash and for all culpable drivers who survived the accident. Information on previous impaired (by alcohol) driving records was obtained from the Alberta Dept. of Transportation, retaining anonymity of those involved. The distributions of variables and cross-tabulations were produced by computer, using the Statistical Package for the Social Sciences (SPSS). In Alberta, 11.1% of drivers responsible for fatal crashes had previous records of alcohol-impaired driving and had been charged one or more times; 87% of tested recidivists were again legally impaired at the time of the accidents studied. Recidivist drivers killed 112 persons, mostly in head-on collisions with other motor vehicles, or in run-off road and overturn crashes. Over half of the recidivist drivers survived the fatal accidents and are probably still driving, as are other recidivists not yet involved in fatal crashes.

by Gerda Bako; Walter C. MacKenzie; E. S. O. Smith

Publ: Canadian Journal of Public Health v68 n2 p106-10 (Apr 1977)

1977; 6refs

Availability: See publication

HS-022 349

HSL 78-01

HS-022 349

CHILDREN'S BEHAVIOR DURING AUTOMOBILE RIDES: DO CAR SEATS MAKE A DIFFERENCE?

The behavior of children riding in automobiles with their mothers was assessed by having an observer accompany them on repeated 15-minute automobile rides, interviews having been conducted with 120 mothers to identify appropriate and inappropriate behaviors on the basis of being inherently hazardous or distracting to the driver. A subjective measure of the mother's overall satisfaction with the children's behavior was obtained after each car ride, on the scale of excellent to intolerable. Children riding in car seats exhibited very high levels of appropriate or safe behavior, whereas children not riding in car seats exhibited very low levels of appropriate behavior. When car seats were introduced to those children who previously had not used them, the level of appropriate behavior improved dramatically. These results were maintained at three-month follow-up observations. Greater use of child safety seats can be achieved if pediatricians point out the improved behavior of the children who use them.

by Edward R. Christophersen
Grant HDO-3144; Grant NICHEN/NIMH-26124
Publ: Pediatrics v60 n1 p69-74 (Jul 1977)
1977; 19refs
Also supported in part by grant from General Motors Love Seat Div.

Availability: See publication; reprints from Dept. of Pediatrics, 215 H. C. Miller Bldg., Univ. of Kansas Medical Center, 39th and Rainbow Blvd., Kansas City, Kans.

HS-022 350

THE VEHICLE ROAD LOAD PROBLEM - AN APPROACH BY NON-LINEAR MODELING

A significant improvement is demonstrated in the coast down technique for determining the road characteristics of a vehicle for chassis dynamometer adjustment. The differentiation of the speed-time data is eliminated while maintaining the ability to treat the forces on the vehicle as a general quadratic function of vehicle speed. Comparison of road load results by the coast down technique and by the drive shaft torque method shows that they are similar when the added flexibility of a linear term is included. The coast down technique requires less instrumentation, however. A model equation for the forces on a freely decelerating vehicle was constructed; this equation was then analytically transformed into an expression for the speed of the freely decelerating vehicle as a function of time. This intrinsically nonlinear equation was then computer fitted to the speed versus time data recorded from the vehicle.

by Glenn D. Thompson
Environmental Protection Agency, Emission Control Technology Div., Ann Arbor, Mich. 48105
Rept. No. PB-270 788; 1975; 34p 9refs
Availability: NTIS

HS-022 351

A FAMILY OF HIGH-STRENGTH STEELS FOR TODAY'S AUTOMOTIVE REQUIREMENTS

New grades of high strength steel are described for vehicle weight reduction to improve fuel economy. Steels in current use include low carbon sheet steel and high strength sheet

steels such as nitrogenized steel-rimmed grade, high-strength low alloy (HSLA) steel-semi killed and killed grade, and ultra high-strength steel-killed grade. For the future, a new family of steels is being developed, with a significant increase in cold rolled types. Yield strength of these steels ranges from 275 to 310 MPa (40 to 45 Ksi). Thinner gage metal with greater yield strength for automobile body components can result in increased strength at lower weight. Consistency of material availability in coil form are important in high volume production of automobile components. New high-strength material should have quality grades such as those used for the current low carbon steels; commercial quality (CQ), drawing quality (DQ), and drawing quality special killed (DQSK). The new materials should have the appropriate compromise between formability and strength so that proper grades for cost effectiveness can be substituted. For grading the new steels, typical mechanical properties of the as-received material should be used. The qualities of yield strength and hardness are improved by straining and aging. Inherent formability of high strength steel is lower than that of low carbon steels, requiring a modification in design and manufacture of parts. Other factors to be considered in the composition of the new steels are weldability, dimensional tolerance, and surface finish and texture. Among the materials being tested for future use are rephosphorized steel, dual phase steel, and heavily temper rolled steel, as well as continuing use of nitrogenized and HSLA steel.

by S. Dinda; A. S. Kasper
Chrysler Corp., Materials Engineering
Rept. No. SAE-770209; 1977; 8p 14refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, Mich., 28 Feb-4 Mar 1977.
Availability: SAE

HS-022 352

EXHAUST GAS TURBOCHARGING FOR PASSENGER CAR DIESEL ENGINES (ABGASTURBOAUFLADUNG FÜR PERSONENWAGEN-DIESELMOTOREN)

Development targets for the OM 617 five-cylinder engine scheduled to be mass produced in 1974 include a four-stroke diesel engine of approximately 3000 cc displacement, with an output of 60 kW in a naturally aspirated engine to 85 kW in the super version. During basic tests to determine the type of supercharging system to be used, 150 kW were achieved with exhaust gas turbocharging. The turbocharged engine has piston cooling, a thicker piston pin, a modified prechamber, and an oil pump drive, none of which is present in the naturally aspirated engine. The output and torque curves are shown for the naturally aspirated engine, for turbocharged engines, and for the world record engine. Operating characteristics for turbine and compressor performance are graphically compared, including the effect of charge air cooling on specific fuel consumption and brake mean effective pressure. Average fuel consumption during the record drive was 19.7 liters per 100 km, oil consumption, 0.7 liters per 1000 km. Measures are described for adapting the engine to a production passenger car. The record drives demonstrate that exhaust gas tur-

bocharging represents an advance in the development of a passenger car diesel engine.

by Hans Scherenberg

Publ: ATZ Automobiltechnische Zeitschrift v79 n11 p479-80, 483-6 (1977)

Rept. No. DK 621.436.054; 1977; 20p Srefs

Test also in German.

Availability: Techtran Corp., P.O. Box 729, Glen Burnie, Md.

HS-022 353

HEADLAMP ILLUMINATION MEASUREMENTS IN REAL TRAFFIC SITUATIONS. PT. 1, A PILOT STUDY TO EVALUATE THE DATA ACQUISITION AND ANALYSIS SYSTEMS

The mobile data acquisition system developed at the National Aeronautical Establishment/National Res. Council (NAE/NRC) Structures and Materials Lab. was used in a pilot study to record headlamp illumination values in real traffic situations. The illuminance produced by a single vehicle's headlamps at the curbside and the regulatory mounted road sign locations was obtained for a number of individual vehicles traveling a straight stretch of highway. The illuminance values obtained in situ differed with the ones inferred from previous headlamp illuminance measurement by 200%. The field factors possibly responsible for this discrepancy include headlamp aim, voltage, cleanliness, vehicle road position, and pitch sensitivity. The relative importance of these factors is being investigated in a static laboratory study of a 30-vehicle sample. A future study will include the investigation of glare from opposing vehicles.

by R. Kulchyski

National Res. Council Canada/National Aeronautical

Establishment, Ottawa, Ont., Canada

Rept. No. LTR-ST-944; 1977; 29p 11refs

Availability: Corporate author

HS-022 354

TRANSPORTATION: ELECTRONICS GALORE. MICROPROCESSORS BROADEN IMPACT ON LAND, SEA, AND AIR TRANSPORT

The use of electronics is leading to many improvements in ground, air, and marine transportation. In both hardware and software areas, important steps are being taken to upgrade service, increase safety, cut costs, conserve energy, and reduce pollution. With microprocessors, as many as 60 different automobile engine functions can be accurately assessed in less than four minutes. Among these functions are primary and secondary ignition, starting, battery charging, fuel-air mixture compression, and timing. Motor vehicle communications systems are improved, with higher capacity, more reliable signaling, greater frequency stabilization, and improved audio quality. Sensors installed in buses help to warn against failures. Air pressure of brakes, oil pressure, and engine temperature are monitored and malfunction automatically signals a dispatch center. Microprocessors and advanced algorithms upgrade traffic control signals to reduce congestion, travel time, and fuel consumption. Automatic vehicle monitoring (AVM) is being field tested. The AVM system includes a communications subsystem for monitoring vehicle status and returning control commands to vehicles, and a computer subsystem for managing information flow, processing incoming data, generat-

ing displays for a dispatcher, and preparing records. An ultrasonic technique for detecting flaws in railroad tracks is being tested and electric railroad performance is being improved. Air transportation may soon benefit from a vortex advisory system being tested at O'Hare airport, which may help to regain landing capacity and to reduce delays at airports. An airborne radar-beacon collision-avoidance system (BCAS) has been tested for warning of the presence of other aircraft within 37 km. To use the system, the aircraft must be equipped with an Air Traffic Control Radar Beacon System (ATCRBS) transponder. Another system provides a light signal at the beginning of runway to confirm voice communication with a traffic controller. Yet another system provides pilots with direct access to weather information. Marine navigation is being upgraded with the expansion of the "Loran C" system and additions to ship displays. A microprocessor-based satellite navigation system for ships is demonstrating good reliability, and systems exist for monitoring ships' structural safety and engine performance. Other applications show progress in controlling pollution in the major bodies of water.

by Gadi Kaplan

Publ: Spectrum v15 n1 p59-62 (Jan 1978)

1978

Availability: See publication

HS-802 153

SAFETY BELT ACTIVITY BOOK. A GUIDE FOR TEACHERS OF GRADES K-6 (ELEMENTARY SCHOOL)

A guide is presented for teachers of kindergarten through sixth grade for training students to use safety belts properly at all times in an automobile and for encouraging students to urge others to use safety belts. The book suggests 20 activities which have been divided into two sections, Learning About Safety Belts and Telling Others About Safety Belts. Activities range from elementary for younger students or slow learners to more advanced for older students or quick learners. Materials to help in the implementation of some of the activities are included. Each activity has been designed for small group or large group use. Small group activities are intended for individual students or for several students working together. Their design is based on the premise that students work best when they can actually participate. Large group activities are meant to be used by one class working together or by one class hosting a presentation for another class.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590

1977; 52p

Safety Belt Instructional Series. Oversize graphic available separately on aperture card.

Availability: GPO \$1.70, Stock No. 050-003-00243-7

HS-802 267

HIGHWAY SAFETY PLAN COURSE. ADMINISTRATIVE AND INSTRUCTIONAL GUIDE

An administrative and instructional guide is presented for conducting a two and one-half day course on Hwy. Safety Planning (HSP), the purpose of which is to communicate the information contained in the National Hwy. Traffic Safety Administration (NHTSA) and Federal Hwy. Administration's (FHWA) Hwy. Safety Prog. Manual, Vol. 102, Hwy. Safety

Plan, Dec 1976, Draft. Participants in the course will learn how to plan state highway safety programs as outlined in the manual. This guide is divided into the following three sections: course organization (describes the organization, content, and schedule of the training program), nature of instruction (describes instructional approaches, supporting rationale, and requirements imposed by the instructional approaches), and course administration (describes preparatory and other requirements for course administration).

by Kenard McPherson; Anne Knipper
National Public Services Res. Inst.
Contract DOT-HS-6-01464

1977; 32p 4refs

See also HS-802 268 (Participant Materials) and HS-802 269 (Instructor Materials).

Availability: GPO

HS-802 268

HIGHWAY SAFETY PLAN COURSE. PARTICIPANT MATERIALS

Participant materials are presented for use in a two and one-half day course on Hwy. Safety Planning (HSP), the purpose of which is to communicate the information contained in the National Hwy. Traffic Safety Administration (NHTSA) and Federal Hwy. Administration's (FHWA) Hwy. Safety Prog. Manual, Vol. 102, Hwy. Safety Plan, Dec 1976, Draft. Participants in the course will learn how to plan state highway safety programs as outlined in the manual. Participant training materials presented herein are to support instructional sessions. The materials include problem-solving exercises and ancillary materials necessary for problem-solving.

by Kenard McPherson; Anne Knipper
National Public Services Res. Inst.
Contract DOT-HS-6-01464

1977; 63p 2refs

See also HS-802 267 (Administrative and Instructional Guide) and HS-802 269 (Instructor Materials).

Availability: GPO

HS-802 269

HIGHWAY SAFETY PLAN COURSE. INSTRUCTOR MATERIALS

Instructor materials are presented for conducting a two and one-half day course on Hwy. Safety Planning (HSP), the purpose of which is to communicate the information contained in the National Hwy. Traffic Safety Administration (NHTSA) and Federal Hwy. Administration's (FHWA) Hwy. Safety Program Manual, Vol. 102, Hwy. Safety Plan, Dec 1976, Draft. Participants in the course will learn how to plan state highway safety programs as outlined in the manual. Units of instruction contain the following subjects: management system; identifying problems; reporting problems; goals and evaluation; solutions; module concept; and operations, documentation, and requirements.

by Kenard McPherson; Anne Knipper
National Public Services Res. Inst.
Contract DOT-HS-6-01464

1977; 175p 2refs

See also HS-802 267 (Administrative and Instructional Guide) and HS-802 268 (Participant Materials).

Availability: GPO

HS-802 270

PROBLEM IDENTIFICATION COURSE. ADMINISTRATIVE AND INSTRUCTIONAL GUIDE

An administrative and instructional guide is presented for conducting a two and one-half day course on Problem Identification (PI), the purpose of which is to communicate the information contained in the National Hwy. Traffic Safety Administration's (NHTSA) PI manual, Problem Identification for Traffic Safety Programs, Vol. 1, Jun 1976. Participants in the course will learn how to utilize procedures and processes to identify state highway safety problems as outlined in the manual. This guide is divided into the following three sections: course organization (describes the organization, content, and schedule of the training program), nature of instruction (describes instructional approaches, supporting rationale, and requirements imposed by the instructional approaches), and course administration (describes preparatory and other requirements for course administration).

by A. James McKnight; Kenard McPherson
National Public Services Res. Inst.
Contract DOT-HS-6-01464

1977; 31p 3refs

Availability: GPO

HS-802 611

APPLICABILITY OF FEDERAL MOTOR VEHICLE STANDARDS TO ELECTRIC AND HYBRID VEHICLES

A summary is presented of present and foreseeable technology in the field of electric and hybrid propulsion systems, as well as an analysis of the applicability of existing and future Federal Motor Vehicle Safety Standards (FMVSS) to the first and second fleet vehicles (demonstration fleets as required by the Electric and Hybrid Vehicle Res., Devel., and Demonstration Act of 1976) and to future electric and hybrid vehicles in general. Most existing standards will be applicable, with certain changes and modifications. A review of all standards will be conducted, and appropriate wording and/or test procedure changes will be made to extend applicability to electrically powered vehicles. Recommendations are made for development of future standards to address hazards associated with the unique propulsion systems of these vehicles.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590

1978; 41p 23refs

Availability: Corporate author

HS-802 688

EMERGENCY MEDICAL SERVICES STATUTES, U.S. STATE AND TERRITORIAL SURVEY

Current information on the status of state and territory emergency medical services (EMS) legislation may be used by the states and territories for purposes of comparison, reference, and review, thereby enabling the states and the EMS Branch of the National Hwy. Traffic Safety Administration (NHTSA) to develop a logical approach to the continued systematic implementation of Standard 11 of the Hwy. Safety Act of 1966, a standard for developing an effective statewide EMS system. In preparing the information presented herein, the following tasks

were performed: collection of existing legislation, development of legislative assessment criteria, development of data tabulation sheets, data tabulation, legislative assessment, narrative summary preparation, and development of model legislation. Information on the following aspects of EMS legislation in the states and territories is tabulated: legislation regarding EMS organization by effective date of most recent amendments of legislation; legislation regarding EMS facilities by effective date of legislation; legislation regarding EMS minimum crew, training levels, certification requirements and effective date; and legislation regarding EMS transportation requirements as specified or by effective date of legislation. Other tables deal with legislation regarding EMS communications by effective date of legislation; legislation regarding EMS insurance requirements; legislation regarding EMS Good Samaritan Laws; legislation regarding EMS evaluation requirements by effective date of legislation; legislation regarding EMS exemptions; and national summary of legislation. Also tabulated are the following: detailed review of advisory boards of state, territory, and region; telephone communications legislation by state, territory, and region; detailed review of ambulance service evaluation elements specified in legislation by state, territory, and region; detailed review of Good Samaritan Law coverage by state, territory, and region; and titles of paramedic personnel and minimum hours of training. Other tables present a detailed review of paramedic legislation by state, territory, and region; summary of the index of explicit compliance to NHTSA Standard 11 in U.S. and territorial legislation on EMS; index of explicit compliance with Standard 11 regarding organization, facilities, and crew/training/certification requirements; index of explicit compliance regarding transportation, communications, and insurance requirements; index of explicit compliance regarding Good Samaritan Laws, evaluation, and exemptions; and net index of explicit compliance.

Public Technology, Inc., 1140 Connecticut Ave., N.W.,
Washington, D.C. 20036
Contract NHTSA-6-5994
1977; 113p 18refs
Availability: NHTSA

HS-802 712

PROGRAM MANUAL FOR MAST PROGRAMS [MILITARY ASSISTANCE TO SAFETY AND TRAFFIC]

This manual is intended to be the official source of information and guidance for the conduct of the Military Assistance to Safety and Traffic (MAST) Prog., a program providing for the use of military helicopters as air ambulances in civilian emergency medical services (EMS). The manual assists active MAST projects in their daily operations and serves as a guide for the establishment of future MAST sites. Criteria are defined and procedures specified for implementation of MAST operations in selected communities that have expressed an interest in establishing a MAST project where a military capability exists and where an air ambulance service is not available commercially. Terms are defined, MAST prerequisites are given, and both local and national organization, duties, and responsibilities are described. Procedures are discussed for patient evacuation and communication. Community and project review checklists are appended. Information presented herein is for use not only for initial planning but also for continued improvement of the project after operating experience is gained. This manual may also be useful as a planning or con-

ceptual guide to those EMS administrators who plan to use helicopters operated by individuals or organizations other than the military services.

MAST Interagency Executive Group
1978; 25p
Availability: NHTSA

HS-803 027

NONRESIDENT VIOLATOR COMPACT OF 1977 [TRAFFIC CITATIONS]

The Nonresident Violator Compact of 1977, which assures nonresident motorists receiving citations for minor traffic violations in a party state the same treatment accorded resident motorists, enables out-of-state motorists to proceed to their destinations without the inconvenience of delay and, at the same time, assures compliance with the terms of the citation. The citizen receiving the citation, the law enforcement agency issuing the citation, and the local court responsible for traffic violations all benefit from this interstate agreement. A nonresident receiving a traffic citation in a party state must fulfill the terms of that citation or face the possibility of license suspension in the motorist's home state until the terms of the citation are met. Safeguards are built into the compact so that a nonresident driver receiving a citation has due process protection. The compact not only assures equal treatment for both residents and nonresidents receiving traffic citations, but it also enhances law enforcement service and deterrence time spent on the highways and increases local traffic court income.

National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Programs, Washington, D.C. 20590
1978; 27p 2refs
Availability: Corporate author

HS-803 028

RESPONSE OF BELTED DUMMY AND CADAVER TO REAR IMPACT. FINAL REPORT

Sled impact tests were conducted to simulate the motion of a standard size car at rest impacted from the rear by a second car of equal weight travelling at 32 mph. The test subjects were anthropomorphic dummies and unembalmed cadavers seated in a bench seat (headrest in its down position) and three-point belted. In one test mode the seatback was held rigid and in a second test mode the seatback rotated rearward in response to the test subject's impact loading. The major kinematic difference, in either test mode, between the dummies and cadavers was that the dummy head oscillated while the cadaver's head did not. Autopsies indicated that all three cadavers tested with a deflecting seatback suffered neck injuries reaching Abbreviated Injury Scale (AIS) 3 while two of three cadavers suffered similar injuries with a rigid seatback. The third cadaver tested with a rigid seatback had no injury. The work reported herein is the first phase of an ongoing study.

by A. S. Hu; S. P. Bean; R. M. Zimmerman
New Mexico State Univ., Physical Science Lab., P.O. Box
3548, Las Cruces, N. Mex. 88003
Contract DOT-HS-5-01201
Rept. No. PR00848; 1976; 443p 14refs
Rept. for Jul 1975-Jun 1976.
Availability: NTIS

HS-803 029

CURRICULUM WORKSHOPS FOR COLLEGE AND UNIVERSITY DRIVER EDUCATION INSTRUCTORS. FINAL REPORT

Ten three-day workshops were conducted throughout the country to introduce the contents of the "Guide for Teacher Preparation in Driver Education" to the potential users, namely, college and university instructors who operate a teacher preparation program in driver education for secondary school instructors. Procedures used to select the workshop participants are described. Contents of the separate sessions comprising the workshop are presented, along with instructors' comments on each. Handouts and training aids, assembled in a separate document, are referenced. Most of the emphasis was placed upon the processes by which educational objectives, content, and methodology may be derived systematically from those driving tasks that are critical to highway safety. The workshop was comprised of twelve 1.5 hour sessions. After an introductory session, there were a series of curriculum design presentations, each followed by an exercise for the participants and a critique. Following these, there were a curriculum priorities exercise and critique, an individual program evaluation exercise, and a workshop evaluation. Evaluations of the workshops by the participants and instructors are summarized, as are recommendations for future workshops.

by Robert Brenner

EVALUATION OF AZOBIS-BLOWN PART 572 DUMMY FINAL REPORT

... were developed and evaluated for Azobis-blowed Nitrosan-blown foams in molding Part ... components. The work was intended to minimize changes in vinyl foam formulations employing Nitrosan as a foaming agent and to establish molding techniques adaptable to production facilities of dummy manufacturers. A data base was established for Nitrosan-blown foams and physical tests performed to establish equivalence between Azobis and Nitrosan-blown foams. Full sets of dummy segments were molded with the Azobis-blown foams and subjected to additional tests to determine that they corresponded reasonably with Nitrosan-blown foams. Azobis-blown dummy segments were produced which proved to be comparable to Nitrosan-blown foam samples. Only minor variations in formulations were required for the substitute material, and only minor variations in molding techniques were necessary. Further work is recommended for some simplification of molding techniques, and additional specifications are recommended on skin thickness on dummy segments, average foam densities for the various segments, and uniformity of densities within each segment.

by Samuel W. Alderson; Steven J. Goldner
Humanoid Systems, 747 E. 223rd St., Carson, Calif. 90745
Contract DOT-HS-6-01325
Rept. No. ATD-105; 1977; 46p
Rept. for Feb 1976-Apr 1977.
Availability: NTIS

HS-803 032

POWER STEERING FAILURE STUDY. FINAL REPORT. VOL. 1: EXECUTIVE SUMMARY

by Richard H. Klein; Henry T. Szostak; Irving L. Ashkenas
Systems Technology, Inc., 13766 S. Hawthorne Blvd.,
Hawthorne, Calif. 90250
Contract DOT-HS-6-01428
Rept. No. TR-1083-1; 1977; 29p 7refs
For abstract, see HS-083 033.
Availability: NTIS

HS-803 033

POWER STEERING FAILURE STUDY. FINAL REPORT. VOL. 2: TECHNICAL REPORT

The feasibility is explored of modifying power steering systems to prevent excessive steering effort resulting from a power steering failure. Field test data are presented which provide the basis for requirements for maximum steering forces, minimum flow rates, and horsepower as a function of vehicle size, maximum allowable delay time (transient time prior to forces exceeding limits), and minimum operation time. For these tests an instrumented, variable power steering test car was used driven by three naive subjects on a closed test course. A power steering pump bypass was tested as one possible means of reducing steering forces due to a failed system, but this method proved totally unsuccessful for all conditions. A tradeoff table describing other candidate implementation schemes versus their estimated cost and capability (elimination of specific power steering failure modes) shows the most cost-effective solution to be an auxiliary motor coupled to the existing power steering pump through two one-way clutches.

by Richard H. Klein; Henry T. Szostak; Irving L. Ashkenas
Systems Technology, Inc., 13766 S. Hawthorne Blvd.,
Hawthorne, Calif. 90250
Contract DOT-HS-6-01428
Rept. No. TR-1083-1; 1977; 100p 14refs
Executive summary is HS-803 032.
Availability: NTIS

HS-803 034

THE COLLECTION OF NATIONAL TREND DATA ON ALCOHOL RELATED CRASHES FOR COMPARISON WITH ALCOHOL SAFETY ACTION PROJECTS RESULTS. FINAL REPORT. VOL. 1. NATIONAL TREND SAMPLE

To study the national trend in alcohol-related crashes, a sample of 14 states was selected, and monthly accident data were collected for each state for the years 1965-1975. The states chosen because they were representative and could provide the required data were the following: Colorado, Delaware, Illinois, Indiana, Mississippi, Nebraska, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Tennessee, and Washington. The variables considered were the following: rural, urban, and total road miles; rural, urban, and total vehicle miles; road density; registered vehicles, miles per vehicle, population; licensed drivers; percentage of population that drives; and travel per licensed driver. Also considered were the following: traffic fatalities per year; liquor consumption; population over 18 years of age; percentage of population

dry; driver's age; drinking age; low and high temperatures; per capita income; percentage of population urban; percentage of drivers under 26 years of age; 402 funding; alcohol funds under 402; percentage of population under ASAP (Alcohol Safety Action Proj.); and population growth rate. Mean and standard deviation are given both for the national average of these variables and the 14 states in the sample, averaged. The z value for difference in mean is also tabulated. The data chosen to be collected for the sample included the following: number of total, fatal, and injury accidents; total and fatal single-vehicle accidents; total and fatal urban and rural accidents; total and fatal ran-off-the-roadway accidents; total and fatal accidents by age of driver; and total and fatal accidents by time of day and day of week. Summary tables of the monthly total and fatal accident statistics for each state in the national sample were developed, graphs of surrogate measures of alcohol-related crashes prepared, and the national trend of such measures analyzed. Both alcohol-related and nonalcohol-related surrogate measures reflected similar trends until the energy crisis of Oct 1973. Although all surrogate measures showed some decrease in accident rates due to the energy crisis and the 55 mph speed limit of Jan 1974, alcohol-related surrogates showed a slower rate of decrease, and it appears that the percentage of fatal accidents that are alcohol-related has been increasing since 1973. Summary tables are appended, as are information on data sources for state variables, data forms, and validation of data. An annotated bibliography of the literature on surrogate measures is also included.

by Judith P. Monaco
SRI International, 333 Ravenswood Ave., Menlo Park, Calif. 94025
Contract DOT-HS-5-01229
1977; 155p 31refs
Rept. for June 1975-Jul 1977. Vol. 2 is HS-803 035.
Availability: NTIS

HS-803 035

THE COLLECTION OF NATIONAL TREND DATA ON ALCOHOL RELATED CRASHES FOR COMPARISON WITH ALCOHOL SAFETY ACTION PROJECTS RESULTS. FINAL REPORT. VOL. 2. ASAP CONTROL SITE DATA

A group of control communities without alcohol safety programs was chosen for Alcohol Safety Action Proj. (ASAP) communities to aid in study of the national trend of alcohol-related crashes. Cities chosen included the following: Norfolk, Va.; Omaha, Nebr.; Des Moines, Iowa; Miami, Fla.; Birmingham, Ala.; Louisville, Ky.; San Diego, Calif.; Tucson, Ariz.; Newark, N.J.; Pittsburgh, Pa. Counties chosen included the following: Polk, Iowa; Dade, Fla.; Pima, Ariz.; Essex, N.J.; San Diego, Calif.; Henrico, Va.; Allegheny, Pa. States chosen included Wyoming, North Dakota, and West Virginia. The ASAP communities with which the control communities were clustered are shown in tabular form. Data were collected for each month of 1968-1975 in the following categories: total and fatal accidents, total and fatal accidents per day of week per hour of day; and total and fatal single vehicle accidents. Some surrogate measures were chosen. Data can be used in the following ways: one ASAP community versus one control community in a cluster; one ASAP community versus all control communities in a cluster; and all ASAP sites versus all control sites. Summary data tables are appended, as is information on candidate control community responses to alcohol questionnaire, data sources for ASAP variables, detailed

characteristics of the eleven clusters, and a copy of the control community coding form.

by Judith P. Monaco
SRI International, 333 Ravenswood Ave., Menlo Park, Calif. 94025
Contract DOT-HS-5-01229
1977; 141p 4refs
Rept. for Jun 1975-Jul 1977. Vol. 1 is HS-803 034.
Availability: NTIS

HS-803 039

NATIONAL PARTS RETURN PROGRAM. FINAL REPORT

The National Parts Return Prog. (PRP) involves the voluntary submittal by independent automotive repair shops of failed automotive components to assist the National Hwy. Traffic Safety Administration (NHTSA) in identifying the existence of safety-related manufacturing defects in design, materials, construction, or performance of motor vehicles and motor vehicle equipment. In addition to failed parts, PRP solicits and receives information from garages on safety-related defects, even if parts are not available. Sometimes photographs are submitted. Parts surveys have been conducted in the PRP News on specific items such as requests for information on worn or grooved brake drums, and on tires (Firestone "Steel Belt" radial 500). Under authority of the National Traffic and Motor Vehicle Safety Act of 1966, as amended, NHTSA can require manufacturers to conduct safety defect recall remedy campaigns when it has been determined that a defect relating to motor vehicle safety exists. The information obtained from parts submitted to the PRP is also valuable in preparing Federal Motor Vehicle Safety Standards. A cumulative report is given of all parts and information received during the period 1 Jul 1976-30 Jun 1977; records are grouped by component classification. For each item listed, the following information is given: bin number; date received; component class; component name, year, and manufacturer; make and model; fault code and hazard category; mileage at failure; and shop number.

by B. Beddow; J. Peizer; L. Mennella
Kappa Systems, Inc., 1501 Wilson Blvd., Arlington, Va. 22209
Contract DOT-HS-6-01433
Rept. No. HS-6-01433-1; 1977; 368p
Rept. for 1 Jul 1976-30 Jun 1977.
Availability: NTIS

HS-803 040

OBSERVED SHOULDER BELT USAGE OF DRIVERS IN NORTH CAROLINA: A FOLLOW-UP. FINAL REPORT

During Oct 1974, shoulderbelt usage was observed for 21,359 drivers in the population at risk in North Carolina. The sample was stratified according to geographic region (mountain, piedmont, coastal), road type, urban/rural location, time of day, and day of week. Information was recorded on shoulderbelt usage of driver, approximate age and sex of driver, and license plate number of vehicle. For N.C. vehicles, license plate numbers were later passed against the vehicle registration file to obtain information on vehicle make, size, and model year. Similar observations were made during Oct 1976 on a smaller sample of 3486 drivers in the piedmont area only.

Results show an overall shoulderbelt usage rate of 10.6% in 1974 and 7.9% in 1976. As expected, usage rates were highest for drivers of newer (post-1973) and smaller-sized cars. Rates were also highest on Interstates and among young drivers and among whites. For the remaining variables, the observed usage rates showed no particular trends of interest. In order to control for some of the most important factors in shoulderbelt usage, maximum likelihood techniques were utilized to fit log-linear models to the 1974 data. Separate models were constructed showing the effects of environmental, vehicle and driver characteristics on shoulder belt usage. The most important of these characteristics were found to be model year, geographic region, and vehicle size, followed in order by road type, time, age, sex, and race. The simultaneous effects of the more important variables were included in a final predictive model, which yielded fitted shoulderbelt usage rates across various factor level combinations. Included in the report is a review of previous safetybelt usage studies.

by Yosef Hochberg; Jane C. Stutts; Donald W. Reinfurt
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C. 27514
Contract DOT-HS-4-00897
1977; 88p 24refs
Rept. for 15 Sep 1974-31 May 1977.
Availability: NTIS

HS-803 041

ACCIDENT INVOLVEMENT AND CRASH INJURY RATES BY MAKE, MODEL, AND YEAR OF CAR: A FOLLOW-UP. FINAL REPORT

In a follow-up to a recent study (Dutt and Reinfurt, 1977), estimates are presented of annual mileages, along with accident and injury rates, for a variety of car sizes as well as for a number of specific vehicle makes and models. In addition, failure rates of four inspection items (headlights, stoplights, footbrakes, and tires) for vehicles undergoing periodic motor vehicle inspection are examined. The various estimates were derived from the North Carolina vehicle registration file, the North Carolina accident file, and a statewide collection of motor vehicle inspection receipts, primarily from Dec 1975. The exposure period in the initial study encompassed the height of the energy crisis while the follow-up represented the post energy crisis, allowing some useful exposure comparisons between the two periods. With a few exceptions, the results of the two studies are quite consistent. All accident and injury rates declined with the newer models; as before, small cars generally had higher involvement and injury rates than either full or middle-sized cars. An investigation of accident driver age by size and model year of car suggests that driver age at least partially accounts for these differences. The follow-up rates were for the most part slightly higher than the rates for the initial study. Older, small cars continued to have higher annual mileages than either full or middle-sized cars, the annual mileage for newer model, small-sized cars being lower in the follow-up study than for the two other size groups. Also, except for new model small cars, there was an increase in estimated annual mileage in the post-energy crisis period. The failure rates of the inspection items studied increased with increasing vehicle age and/or mileage, with headlight failure rates at least twice as great as those of any of the other items. The interaction between vehicle age and mileage on item

failure rates found here is consistent with previous study results.

by Amitabh K. Dutt; Donald W. Reinfurt
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C. 27514
Contract DOT-HS-4-00897
1977; 144p 7refs
Rept. for 1 Dec 1975-30 Jun 1977.
Availability: NTIS

HS-803 058

DYNAMIC RESPONSE OF HUMAN AND PRIMATE HEAD AND NECK TO 0GY IMPACT ACCELERATION. FINAL REPORT

In the first study of human and chimpanzee response to lateral (0Gy) impact acceleration, three-dimensional inertial instrumentation was applied to the head and the first thoracic vertebral (T1) body. Thirty-four experiments are reported on six human volunteers under peak sled acceleration forces of from 2.0 G to 7.5 G. Twelve chimpanzee experiments were conducted with head and T1 measurement systems identical to those used on human subjects, with peak sled acceleration forces of from 6 G to 20 G. The data indicate that the human lateral response is much greater than the -Gx response previously reported. These findings are consistent with the relatively high incidence of neck stiffness and soreness in the human volunteers. Photo-derived variables agree closely with those of accelerometer data. The data also indicate that the response of the chimpanzee's head was considerably more complex, due to higher acceleration levels in the sled runs, a different head center of gravity, and different initial physical condition. There may be interspecies differences crucial to the dynamic response. Chimpanzees were found to have a different T1 response compared to humans. Detailed cardiopulmonary and physiological measurements are necessary in the control of these experiments and in the effort to set acceleration limits for humans.

by C. L. Ewing; D. J. Thomas; L. Lustick; G. C. Willems; W. H. Muzzy; E. B. Becker; M. E. Jessop
Naval Aerospace Medical Res. Lab. Detachment, P.O. Box
29407, New Orleans, La. 70189
Contract DOT-HS-4-00852
1978; 758p 51refs
Rept. for May 1974-May 1976.
Availability: NTIS

HS-803 064

IDENTIFICATION OF UNSAFE DRIVING ACTIONS AND RELATED COUNTERMEASURES. FINAL REPORT

An analysis was made of accident data from a three-county area in North Carolina to identify a set of unsafe driving actions (UDA's) and determine their relative frequencies in accidents. Through field observations at accident locations, frequencies of occurrence were estimated and subsequently used to calculate relative risk factors for a selected group of UDA's (speeding, following too closely, driving left of center, running a traffic control, turning in front of oncoming traffic, and pulling in front of oncoming traffic). The frequencies of traffic citations were estimated for comparison with accident frequency and relative risks to determine any differences in accident causation and police enforcement priorities. Turning

June 30, 1978

HS-803 078

in front of oncoming traffic was found to be the highest risk behavior, three times that of pulling in front of oncoming traffic, which ranked second. Following too closely and running a contact ranked third and fourth. Driving left of center and speeding had lower risk factors. Although speeding appeared to be the least risky behavior, it was the one most often cited. However, when speeds exceeded the posted limit by more than 10 mph, the risk was much greater. Following too closely was first in accident frequency and third in accident risk, but it was rarely cited. A characterization of each of the six UDA's is provided in terms of its dynamics, situational factors, role in accidents, relative risk factors, citation frequencies, driver profiles, and recommended enforcement policies.

by Lorraine S. de Savornin Lohman; Elizabeth C. Leggett; J. Richard Stewart; B. J. Campbell
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C. 27514
Contract DOT-HS-5-01259
1976; 152p 2refs
Rept. for 1 Jul 1975-31 Dec 1976.
Availability: NTIS

HS-803 065

A MANUAL FOR EVALUATING THE PERFORMANCE OF THE ELECTRICAL CIRCUITRY OF THE GENERAL MOTORS AIR CUSHION RESTRAINT SYSTEM

A manual is presented for evaluating the performance of the electrical circuitry of the General Motors air cushion restraint system (ACRS). The discussion of ACRS electrical circuitry is based on the investigation of many crashes involving ACRS-equipped vehicles and available descriptive technical literature. Design features of the ACRS include the ability to differentiate between crash deceleration thresholds, monitoring of the ready condition of the system, and crash sensing. Also, time elapsed since a system malfunction was indicated is recorded. Methods to determine levels of deployment, gas pressure failure, nondeployment in a crash, and crash severity beyond ACRS capability are described. This information is presented to permit crash investigators to more effectively evaluate ACRS performance once a crash has occurred.

by Peter Cooley
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48109
Contract DOT-HS-4-00890
Rept. No. UM-HSRI-77-38; 1977; 22p 4refs
See also HS-021 233.
Availability: Corporate author

HS-803 075

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 1

Total content of this report is composed of graphs presenting results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grad-

ing (UTQG) procedure. Tests in this unit were made in Aug and Sep 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron,
Ohio 44303
Contract DOT-HS-5-01224
1977; 214p
Availability: Reference copy only

HS-803 076

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 2

Total content of this report is composed of graphs presenting results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Aug and Sep 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron,
Ohio 44303
Contract DOT-HS-5-01224
1977; 213p
Availability: Reference copy only

HS-803 077

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 3

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Aug and Sep 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron,
Ohio 44303
Contract DOT-HS-5-01224
1977; 199p
Vol. 1 is HS-803 074; Vol. 2, sec. 1 and 2 are HS-803 075 and HS-803 076, and sec. 4-11 are HS-803 078-HS-803 085.
Availability: Reference copy only

HS-803 078

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 4

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of

the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in the unit were made in Aug and Sep 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron, Ohio 44303
Contract DOT-HS-5-01224
1977; 222p
Vol. 1 is HS-803 074; Vol. 2, sec. 1-3 are HS-803 075--HS-803 077, and sec. 5-11 are HS-803 079--HS-803 085.
Availability: Reference copy only

HS-803 079

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 5

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Sep and Oct 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron, Ohio 44303
Contract DOT-HS-5-01224
1977; 252p
Vol. 1 is HS-803 074; Vol. 2, sec. 1-4 are HS-803 075--HS-803 078, and sec. 6-11 are HS-803 080--HS-803 085.
Availability: Reference copy only

HS-803 080

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 6

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Oct 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron, Ohio 44303
Contract DOT-HS-5-01224
1977; 200p
Vol. 1 is HS-803 074; Vol. 2, sec. 1-5 are HS-803 075--HS-803 079, and sec. 6-11 are HS-803 080--HS-803 085.
Availability: Reference copy only

HS-803 081

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 7

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Oct and Dec 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron, Ohio 44303
Contract DOT-HS-5-01224
1977; 207p
Vol. 1 is HS-803 074; Vol. 2, sec. 1-6 are HS-803 075--HS-803 080, and sec. 8-11 are HS-803 802--HS-803 085.
Availability: Reference copy only

HS-803 082

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 8

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Dec 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron, Ohio 44303
Contract DOT-HS-5-01224
1977; 190p
Vol. 1 is HS-803 074; Vol. 2, sec. 1-7 are HS-803 075--HS-803 081, and sec. 9-11 are HS-803 083--HS-803 085.
Availability: Reference copy only

HS-803 083

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC. 9

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading

(UTQG) procedure. Tests in this unit were made in Nov and Dec 1976.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron,
Ohio 44303
Contract DOT-HS-5-01224
1977; 167p
Vol. 1 is HS-803 074; vol. 2, sec. 1-8 are HS-803 075--HS-803
082, and sec. 10-11 are HS-803 084--HS-803 085.
Availability: Reference copy only

HS-803 084

**VALIDATION OF STANDARD SURFACE
REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC.
10**

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Nov 1976 and Apr 1977.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron,
Ohio 44303
Contract DOT-HS-5-01224
1977; 173p
Vol. 1 is HS-803 074; vol. 2, sec. 1-9 are HS-803 075--HS-803
083, and sec. 11 is HS-803 085.
Availability: Reference copy only

HS-803 085

**VALIDATION OF STANDARD SURFACE
REPRODUCIBILITY. FINAL REPORT. VOL. 2, SEC.
11**

This report, composed entirely of graphs, presents results of tests of skid surface reproducibility, utilizing a two-wheel skid trailer and the reference surfaces of the Field Test Center of the Federal Hwy. Administration. Tests were made on American Society for Testing and Materials (ASTM) tires and production tires in various sizes and constructions. The testing methods conformed to the Uniform Tire Quality Grading (UTQG) procedure. Tests in this unit were made in Apr and May 1977.

by James E. Shearer; Richard D. Van Arnam
Smithers Scientific Services, Inc., 425 W. Market St., Akron,
Ohio 44303
Contract DOT-HS-5-01224
1977; 185p
Vol. 1 is HS-803 074; vol. 2, sec. 1-10 are HS-803 075--HS-803
084.
Availability: Reference copy only

HS-803 152

**HOLOGRAPHY IN DRIVER EDUCATION,
TRAINING, TESTING, AND RESEARCH. FINAL
REPORT**

An experiment was devised to create a safe, realistic, and economical method to hazard-train student drivers on the roadway. After an extensive literature search of previous experimentation and an analysis of seven possible training methods, a preprototype model of a holographic student training car was constructed and tested. The holographically recreated objects, projected by automobile roof apparatus and displayed on the road by a windshield film, were found to be the safe, realistic, and economical method needed for the hazard training. The holographic images were judged to be realistic by drivers in a pilot study, when the holograms were correct in brightness with respect to the ambient lighting conditions. The most effective hologram was that of a vehicle cutting in front of the subject. The holograph and dummy systems appear to have similar capabilities to accelerate driver training and to test driver response in on-road and on-range situations at approximately the same cost. The holograph system may require a slightly higher development expense, offset by lower maintenance and modification costs. It appears that holography will have on-range uses before it is useful for on-road applications. It could be used in hazard avoidance tests and depth perception studies. A period of research and development is essential to acquire techniques for producing long-range, large scale holograms of suitable subjects. Studies will be undertaken in full range color and motion holography and on-vehicle image intensity control. A second phase of development will involve the production and demonstration of a vehicle for twilight holographic displays.

by Edwin S. Eichert, 3rd; Allan H. Frey
Randomline, Inc., County Line and Mann Rds., Huntingdon
Valley, Pa. 19006
Contract DOT-HS-5-01221
1977; 100p 43refs
Rept. for Jul 1975-Jan 1977.
Availability: NTIS

HS-803 191

**DAMAGE TO VEHICLE SAFETY AND ENGINE
EXHAUST SYSTEMS IN COLLISIONS. FINAL
REPORT**

Two hundred and eighty-eight collision damaged vehicles of the model years 1968-1977 were inspected for damage to their safety and engine exhaust emission systems as well as for pre-collision noncompliance with established standards. The collected inspection data, 2453 in all, were evaluated for statistically significant damage occurrence and/or pre-collision non-compliance and correlations between statistically significant occurrences of damage and substandard operation associated with the type of accident and extent of crash damage. The program data revealed that many types of information are accessible and that a thorough evaluation of vehicles involved in accidents is available from this type of program. A statistically large number of accident involved vehicles had poor components in their brake system. The friction material was thinner than the acceptable safe level on 27% of the vehicles; 31% had low brake fluid. Thirty-three percent of the vehicles exhibited alignment problems. Emission tests revealed excessive hydrocarbons were emitted at idle by 20% of the vehicles and at 2500 rpm by 11%. Inspection of pollution control

devices indicated that 15% required air cleaner replacement and 8% had some pollution control devices disconnected. Energy absorbing bumper systems were damaged on 17% of the vehicles and torn sheet metal resulted on 46%. Lamps were damaged in 22% of the accidents and were not functioning properly prior to the accident on another 22% of the vehicles. Reflecting devices showed a similar pattern. Power steering belts were loose or worn on 15% of the cars and 9% exhibited transmission level misalignment.

by John N. Noettl
Automobile Club of Missouri, 201 Progress Pkwy., Maryland Heights, Mo. 63043
1977; 141p
Availability: NHTSA Technical Reference Branch, microfiche only

HS-803 192

IMPACT OF DISCONTINUING IDAHO'S VEHICLE INSPECTION PROGRAM - BEFORE STUDY. FINAL REPORT

A before-study was conducted when the State of Idaho repealed its mandatory vehicle inspection program in 1976. The study was made on vehicles with a valid inspection certificate to establish baseline data, and an after-study was planned for 1978 to determine deterioration in the mechanical condition of vehicles after two years without an inspection program. The NHTSA Experimental Mobile Motor Vehicle Inspection Facility was effectively used. It was recommended that in future a police officer select vehicles to be inspected, since volunteer drivers could produce results weighted toward conscientiously maintained vehicles. The report has been structured to provide implementation methodology for a state-wide, random sample study. Comparison with previous data, such as that in an Indiana study, indicates that the main similarity is increased defects in older model vehicles. The comparison enhances the confidence level of the Idaho study.

Idaho Transportation Dept., Bureau of Hwy. Safety, P.O. Box 7129, Boise, Idaho 83707
Contract DOT-HS-6-01482
1977; 68p
Availability: NHTSA Technical Reference Branch, microfiche only

HS-803 206

BICYCLE SAFETY HIGHWAY USERS INFORMATION REPORT

An analysis of the "Bikecentennial" event on a bicycle route across the U.S. has indicated that a tremendous potential exists for reducing bicycle accidents through the encouragement of preferred bicycle roads. By selecting and improving potentially popular bicycling corridors, and by initiating an effective education and enforcement program, it is possible to reduce bicycling accidents in this country by up to 50% of the current rate. A profile of nonaccident riders was established, characterized by mature age (26-35 and 46-55). These riders were married, had established definite riding technique, normally obeyed traffic regulations, always wore bright clothing, made periodic safety checks of their equipment, normally rode with care, and seldom needed to make repairs. Hazard avoidance techniques such as emergency braking, road abandonment, and dealing with unstable surfaces (gravel) can be practiced to

reduce accident frequency and severity. Collisions between bicycles were the most frequent cause of accidents (20%); broken pavement accounted for 10.7%; bicycles hit by cars caused 7.8%; loss of control, 6.5%; crash of bicycle to avoid car, 5.8%; loose gravel, 5.2%; fall of rider, 4.9%; and slipped on gravel road, 2.6%. Downhill sites are high accident risk areas. Rider fatigue and equipment overloads are shown to be factors in bicycle accidents. Of bicycle injuries, 51% consisted of cuts and scrapes, followed by bruises (13.2%), lacerations requiring stitches (7.2%), sprains (4.9%), and fractures and concussions (each 3.3%). Bicycle accidents were found to be largely unreported to law enforcement officials, or to medical or insurance officials. The presence of trained leaders reduces the accident level of a group. Motor vehicle blast or suction can knock bicycles off the road or under vehicles. Bicyclists must be alerted to the major causes of accidents, taught standard rules of the road and defensive riding techniques, and become aware of the importance of helmets, bright clothing, safety accessories, and correct use of equipment. This system must be backed up with greater uniformity in laws, stern enforcement, and judicial support. Bicycling safety in America must be viewed as a system.

by Bruce Burgess; Dan Burden
Bikecentennial, Inc.
NHTSA-7-3200
1977; 151p
Availability: NHTSA

HS-803 207

AUTOMOTIVE FUEL ECONOMY PROGRAM. SECOND ANNUAL REPORT TO THE CONGRESS. JANUARY, 1978

During fiscal year 1977, the Office of Automotive Fuel Economy (OAFE) established production-weighted average passenger automobile fuel economy standards for model years 1981 through 1984, and average nonpassenger automobile (NPA) fuel economy standards for model year 1979. NPA's include light-duty pickup trucks, vans, and general utility vehicles of less than 6000 lbs GVWR. OAFE also promulgated regulations establishing procedures, definitions, and reports to support these standards. The 1981-1984 average fuel economy standards are estimated to result in savings of 590,000 barrels per day in 1985, and 1.2 million barrels per day in 1995 over 1980 standard savings. Cumulated savings by 1995 are estimated to be worth \$24 billion. In the long run, fuel economy standards are expected to save consumers money, due to lower fuel consumption and reduced maintenance. The domestic automobile industry will have to spend an extra \$4.6 billion between 1977 and 1981 for machinery and special tooling, and domestic NPA manufacturers \$10.8 million by 1979. NPA fuel economy standards are estimated to save 6684 barrels per day over 1976 levels, or a saving of 24.40 million barrels for the lifetime (10 years) of the NPA fleet. Regulations promulgated for administering the fuel economy program include vehicle classification, manufacturer responsibility for multistage automobiles, exemption from or reduction of fuel economy standards, and automobile fuel economy reports.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy, Washington, D.C. 20590
1977; 44p 7refs
Preprint
Availability: NHTSA

HS-803 208

COMPUTER SIMULATION OF HUMAN THORACIC SKELETAL RESPONSE - ABSTRACT. SUMMARY REPORT

by M. M. Reddi; H. C. Tsai
Franklin Inst. Res. Labs., 29th and Race Streets, Philadelphia, Pa. 19103
Contract DOT-HS-5-01180
Rept. No. F-C4216-1; 1977; 24p 11refs
For abstract see HS-803 209.
Availability: NTIS

HS-803 209

COMPUTER SIMULATION OF HUMAN THORACIC SKELETAL RESPONSE - THEORY. FINAL REPORT. VOL. 1

Work was continued on the THORAX finite element model of the human chest in an impact environment. In an effort to reduce costs and computer time, the modeling effect was limited to the bony cage only. Experimental data for validation were available or were developed in the course of the study. It was observed that 60% of all chest trauma from accidents were nonpenetrating injuries, with an 85% incidence of rib fracture, indicating that the model would cover a significant sample of chest injuries. The minimum requirements for a computationally practical bony cage model were established as a reasonably small number of degrees of freedom, and a large deformation capability. These criteria were met by an element developed on the "elastica" theory. Comparisons were made between experimental data and the mathematical model of a bony cage under blunt frontal impact, under harness restraint, and under restraint by airbag-equipped, energy-absorbing steering column. Results indicated that the model is valid for simulating thoracic behavior under these conditions.

by M. M. Reddi; H. C. Tsai
Franklin Inst. Res. Labs., 29th and Race Streets, Philadelphia, Pa. 19103
Contract DOT-HS-5-01180
Rept. No. F-C4216-1; 1977; 223p refs
Summary rept. is HS-803 208. Rept. for 26 Jun 1975-31 Jan 1977.
Availability: NTIS

HS-803 211

A FINITE ELEMENT HEAD INJURY MODEL. FINAL REPORT. VOL. 1: THEORY, DEVELOPMENT, AND RESULTS

The results of a head injury model development program are presented, including a description of the resulting model's features and its capabilities for simulating direct and indirect impact forces. Attempts at quantitative validation have not been successful, as the bone finite element characterization is too stiff. Skull bone response and brain response are presented for a variety of dynamic simulations. Over 75 dynamic and static computer runs have been executed in its development. The basic features of the model include recognizable skull geometry, linear elastic and linear visco-elastic behavior, and a capability for specifying arbitrary impact loads and boundary conditions. A special modification of the isoparametric element is shown to be particularly suited to simulation of the

dynamic response of nearly incompressible brain matter. A preprocessor enables automatic mesh generation of a skull model consistent with a prescribed set of geometrical data supplied by the user. Either complete three-dimensional skulls or skulls symmetrical with respect to the midsagittal plane can be specified in the mesh generation process. Scale factors can be prescribed which modify existing skull meshes and achieve parametric control on size and shape. A postprocessor facilitates the reduction of the large amount of data that is typical of a head impact simulation. The results demonstrate that while some minor changes appear indicated, the model predictions yield useful insight into the mechanical causes of skull and brain injury. Appended is a clinical description of head injury.

by T. A. Shugar
Naval Construction Battalion Center, Civil Engineering Lab., Port Hueneme, Calif. 93043
Contract DOT-HS-289-3-550-1A
1977; 210p 103refs
Vol. 2 is HS-803 212. Rept. for Jun 1973-Sep 1976.
Availability: NHTSA

HS-803 212

A FINITE ELEMENT HEAD INJURY MODEL. FINAL REPORT. VOL. 2: COMPUTER PROGRAM DOCUMENTATION

Necessary information and documentation for executing the head injury model (HIM) computer program is presented. Documentation includes a user's manual, a flow chart, CDC 6600 control cards, sample input data, and a Fortran IV source code listing of the HIM program. In addition, listings are provided for a preprocessor (skull mesh generator), a bandwidth minimizer, and a subroutine for an improved finite element for simulating the load-deformation response of the skull.

by T. A. Shugar
Naval Construction Battalion Center, Civil Engineering Lab., Port Hueneme, Calif. 93043
Contract DOT-HS-289-3-550-1A
1976; 161p
Vol. 1 is HS-803 211. Rept. for June 1973-Sep 1976.
Availability: NHTSA

HS-803 213

THE DRINKING DRIVER. AN INTERDISCIPLINARY APPROACH TO THE LEGAL MANAGEMENT OF A SOCIAL PROBLEM. PT. 2, VOL. 1

The current legislative status of the potential legislative alcohol countermeasures analyzed in Pt. 1 is described for Alabama through Kansas in an alphabetical listing of the states. These countermeasures include problem management, preliminary breath screening laws, and authority to arrest without a warrant in misdemeanor cases. Also included are blood alcohol level laws, presentence reports, and mandatory jail terms for driving under the influence (DUI). Other countermeasures are impounding and forfeiture, civil commitment of alcoholics, dram shop acts, and mandatory license withdrawal and restricted licenses. Suspension or revocation of registration certificates and plates for DUI are considered, with possible issuance of special certificates and plates. Also

HS-803 214

considered are reporting of alcoholics to state agencies and courts, and insurance penalties.

University of Denver Coll. of Law
Contract DOT-HS-126-2-352
1973; 211p

Vols. 2 and 3 are HS-803 214 and HS-803 215.
Availability: Reference copy only

HS-803 214

**THE DRINKING DRIVER. AN INTERDISCIPLINARY
APPROACH TO THE LEGAL MANAGEMENT OF A
SOCIAL PROBLEM. PT. 2, VOL. 2**

The current legislative status of the potential legislative alcohol countermeasures analyzed in Pt. 1 is described for Kentucky through New York in an alphabetical listing of the states. These countermeasures include problem management, preliminary breath screening laws, and authority to arrest without a warrant in misdemeanor cases. Also included are blood alcohol level laws, presentence reports, and mandatory jail terms for driving under the influence (DUI). Other countermeasures are impounding and forfeiture, civil commitment of alcoholics, dram shop acts, and mandatory license withdrawal and restricted licenses. Suspension or revocation of registration certificates and plates for DUI are considered, with possible issuance of special certificates and plates. Also considered are reporting of alcoholics to state agencies and courts, and insurance penalties.

University of Denver Coll. of Law
Contract DOT-HS-126-2-352
1973; 210p

Vols. 1 and 3 are HS-803 213 and HS-803 215.
Availability: Reference copy only

HS-803 215

**THE DRINKING DRIVER. AN INTERDISCIPLINARY
APPROACH TO THE LEGAL MANAGEMENT OF A
SOCIAL PROBLEM. PT. 2, VOL. 3**

The current legislative status of the potential legislative alcohol countermeasures analyzed in Pt. 1 is described for North Carolina through Wyoming in an alphabetical listing of the states. The District of Columbia and Puerto Rico follow. These countermeasures include problem management, preliminary breath screening laws, and authority to arrest without a warrant in misdemeanor cases. Also included are blood alcohol level laws, presentence reports, and mandatory jail terms for driving under the influence (DUI). Other countermeasures are impounding and forfeiture, civil commitment of alcoholics, dram shop acts, and mandatory license withdrawal and restricted licenses. Suspension or revocation of registration certificates and plates for DUI are considered, with possible issuance of special certificates and plates. Also considered are reporting of alcoholics to state agencies and courts, and insurance penalties.

University of Denver Coll. of Law
Contract DOT-HS-126-2-352
1973; 222p

Vols. 1 and 2 are HS-803 213 and HS-803 214.
Availability: Reference copy only

HS-803 217

**MOTORCYCLE EDUCATION CURRICULUM
SPECIFICATIONS. FINAL REPORT**

Six units of instruction are prescribed to reduce the incidence and severity of motorcycle accidents. Each unit contains objectives, prerequisites, methods, materials, equipment, facilities, and proficiency measures. Basic riding skills, street riding principles and skills, and maintenance are included, as are off-street operation and preparation for travel. The instructional units can be configured in a variety of ways in order to accommodate the range of interests and experience levels that characterize individuals seeking motorcycle instruction. Six specific courses have been identified, including those for basic on-street and off-street operation, a comprehensive, or composite, course, an improvement course, and transition courses. An instructional program was developed from the specifications by the Motorcycle Safety Foundation. It was pilot-tested on 48 students during the summer of 1976. The specifications have been revised to reflect experiences gained during the pilot test.

by A. James McKnight; Kenard McPherson; Duane R. Johnson
National Public Services Res. Inst., 421 King St., Alexandria, Va. 22314
Contract DOT-HS-5-01182
1977; 403p
Rept. for Jun 1975-Apr 1977.
Availability: NTIS

HS-803 219

**RESEARCH SAFETY VEHICLE (RSV). PHASE 3.
STATUS REPORT NO. 6, 1 NOVEMBER TO 31
DECEMBER 1977. VOL. 1**

At the Bidders' Briefing, four Detroit firms were given the build definition of the 17 cars desired and information concerning the pedestrian crash buck, quality control, and restraint systems. Validation sled tests of the occupant restraint system were satisfactorily completed. Test of two static vehicles were completed in the crusher to provide load deflection curves for front, side, and rear impacts. Costs for the RSV, Phase 3, are tabulated. Most of the Phase 3, RSV body design is completed and the chassis is nearing completion. Front structure design has been finalized in Phase 4 configuration, subject to validation testing and impact simulation. RSV dimensions are tabulated, compared to Simca C-6. The 90° side static crush test of Crush Vehicle No. 2 has been completed and is compared with a Phase 2 test. Davidson has provided foam samples of the rear bumper for testing. The final design of the hood secondary safety latch is complete for Phase 4. Neoprene-coated nylon air belt covers were successfully tested in two static deployments and a dynamic sled test. A packaging layout of the installation of the Chrysler Subcompact 1716 cc 4 cylinder engine has been completed, as have detail designs of the halfshafts for automatic transaxles, as well as modifications of the manual transaxle engine mounts and of the transaxle exhaust system design. The Electronic Spark Advance Control unit mounting has been revised. A design has been completed for suspension brackets to mount sensors for the antiskid brake system and the Low Tire Pressure system. A new attachment bracket and pivot bar have been designed to maintain the carryover Simca 1308 upper control arm, and the rear torsion bar anchor has been redesigned. A Phase 3 rear suspension layout has been

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completed, as has a Phase 3 fuel tank design. In general, the clay model of the RSV has been completed, including a mock-up of the aerodynamic side view mirror. Dynamic Car No. 1 was completed and shipped to Calspan Corp. Dynamic Car No. 2 was completed in body-in-white configuration. Crush tests were completed on Static Car No. 2, as was validation sled testing of the RSV air belt and rear seat restraint systems. A large part of the test program was completed for demonstrating the RSV accident avoidance characteristics. Steady state yaw response data have been accumulated from 50 runs covering a range of speed and lateral accelerator values. Transient yaw response was measured over 25 runs, while free control response was measured in about 20 runs. Approximately 10 runs were performed for testing control at breakaway, with results depending heavily on driver inputs, and disturbance response characteristics were similarly measured. Maneuvers were performed to test overturning immunity.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-7-01551
Rept. No. ZN-6069-V-7; 1977; 104p
Vol. 2 is HS-803 220.
Availability: Reference copy only

HS-803 220

RESEARCH SAFETY VEHICLE (RSV). PHASE 3. STATUS REPORT NO. 6. VOL. 2

The parts book for the research safety vehicle (RSV) body (Appendix A) and chassis (Appendix B) is presented, as provided at the Builders' Briefing. An analysis follows of the Cibie prototypes of interior adjusting halogen headlights and high-level rear lights for the Chrysler RSV (Appendix C). This analysis is an English translation of the original French document. The optical unit was satisfactory according to specifications proposed before the study. Comparison was made with a good 7-inch American headlamp in terms of visibility distance during casual attention on a two-lane highway, on an expressway, and on a winding road. The prototype was shown to be of high quality in terms of visibility distance for distracted attention, driving comfort, and beam width and homogeneity, but had a strong dazzle in the case of significant high misaim of the beam.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-7-01551
Rept. No. ZN-6069-V-7; 1977; 160p
Vol. 1 is HS-803 219.
Availability: Reference copy only

HS-803 224

CAR-TO-CAR IMPACT TESTING (TASK 3). TEST 3, TYPE OF TEST: CAR-TO-CAR SIDE IMPACT. INTERIM FINAL REPORT

A 1976 four-door Plymouth Volare was impacted by a 1975 Ford Torino in a test conducted as part of a program for evaluating the improvement in side impact crashworthiness of a compact size production automobile incorporating improved front door structural characteristics. Door modifications include increased depth of door beam hat sections, sheet metal reinforcement on one side of the door beam, and strengthened beam tie-ins. The door beam was lowered about three inches, tabs were added to the door bottom to lock the sill in with the door, and joints in the sheet metal facing were continuously

welded. Nuts were placed on the door hinges. In this test, the right side of the Volare with a modified right front door (no interior padding) was impacted at a 60° angle at 25 mph impact speed. All test results are presented without analysis or discussion. Included are the still photographs, the electronic data in plotted form, vehicle damage sketches and tabulated pre-test and post-test dimensions, accelerometer location identification, and summaries of the simulated occupancy data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the sponsor.

by E. Enserink
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix,
Ariz. 85027
Contract DOT-HS-5-01104
1977; 58p
Availability: Reference copy only

HS-803 225

CAR-TO-CAR IMPACT TESTING (TASK 3). TEST 4, TYPE OF TEST: CAR-TO-CAR SIDE IMPACT. INTERIM FINAL REPORT

A 1976 four-door Plymouth Volare was impacted by a 1975 Ford Torino in a test conducted as part of a program for evaluating the improvement in side impact crashworthiness of a compact size production automobile incorporating improved front door structural characteristics. Door modifications include increased depth of door beam hat sections, sheet metal reinforcement on one side of the door beam, and strengthened beam tie-ins. The door beam was lowered about three inches, tabs were added to the door bottom to lock the sill in with the door, and joints in the sheet metal facing were continuously welded. Nuts were placed on the door hinges. In this test, the left side of the Volare with a modified left front door (no interior padding) was impacted at a 90° angle at 35 mph impact speed. All test results are presented without analysis or discussion. Included are the still photographs, the electronic data in plotted form, vehicle damage sketches and tabulated pre-test and post-test dimensions, accelerometer location identification, and summaries of the simulated occupancy data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the sponsor.

by E. Enserink
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix,
Ariz. 85027
Contract DOT-HS-5-01104
1977; 62p
Availability: Reference copy only

HS-803 226

CAR-TO-CAR IMPACT TESTING (TASK 3). TEST 5, TYPE OF TEST: CAR-TO-CAR SIDE IMPACT. INTERIM FINAL REPORT

A 1976 four-door Plymouth Volare was impacted by a 1975 Ford Torino in a test conducted as part of a program for evaluating the improvement in side impact crashworthiness of a compact size production automobile incorporating improved front door structural characteristics. Door modifications include increased depth of door beam hat sections, sheet metal reinforcement on one side of the door beam, and strengthened beam tie-ins. The door beam was lowered about three inches, tabs were added to the door bottom to lock the sill in with the

door, and joints in the sheet metal facing were continuously welded. Nuts were placed on the door hinges. In this test, the right side of the Volare with a modified right front door (no interior padding) was impacted at a 60° angle at 35 mph impact speed. All test results are presented without analysis or discussion. Included are the still photographs, the electronic data in plotted form, vehicle damage sketches and tabulated pre-test and post-test dimensions, accelerometer location identification, and summaries of the simulated occupancy data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the sponsor.

by E. Enserink
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix,
Ariz. 85027
Contract DOT-HS-5-01104
1977; 62p
Availability: Reference copy only

HS-803 227

CAR-TO-CAR IMPACT TESTING (TASK 3). TEST 6, TYPE OF TEST: CAR-TO-CAR SIDE IMPACT. INTERIM FINAL REPORT

A 1976 four-door Plymouth Volare was impacted by a 1975 Ford Torino in a test conducted as part of a program for evaluating the improvement in side impact crashworthiness of a compact size production automobile incorporating improved front door structural characteristics. Door modifications include increased depth of door beam hat sections, sheet metal reinforcement on one side of the door beam, and strengthened beam tie-ins. The door beam was lowered about three inches, tabs were added to the door bottom to lock the sill in with the door, and joints in the sheet metal facing were continuously welded. Nuts were placed on the door hinges. In this test, the right side of the Volare with a modified right front door (added aluminum honeycomb interior padding) was impacted at a 60° angle at 35 mph impact speed. All test results are presented without analysis or discussion. Included are the still photographs, the electronic data in plotted form, vehicle damage sketches and tabulated pre-test and post-test dimensions, accelerometer location identification, and summaries of the simulated occupancy data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the sponsor. Intrusion was generally higher in this test, due to inadequate spot welding of the "A" pillar in the Volare, which was not part of the door modification. It was decided to do a full weld on this joint for all subsequent tests.

by E. Enserink
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix,
Ariz. 85027
Contract DOT-HS-5-01104
1977; 64p
Availability: Reference copy only

HS-803 228

CAR-TO-CAR IMPACT TESTING (TASK 3). TEST 7, TYPE OF TEST: CAR-TO-CAR SIDE IMPACT. INTERIM FINAL REPORT

A 1976 four-door Plymouth Volare was impacted by a 1975 Ford Torino in a test conducted as part of a program for evaluating the improvement in side impact crashworthiness of

a compact size production automobile incorporating improved front door structural characteristics. Door modifications include increased depth of door beam hat sections, sheet metal reinforcement on one side of the door beam, and strengthened beam tie-ins. The door beam was lowered about three inches, tabs were added to the door bottom to lock the sill in with the door, and joints in the sheet metal facing were continuously welded. Nuts were placed on the door hinges. In this test, the right side of the Volare with a modified right front door (added aluminum honeycomb interior padding) was impacted at a 60° angle at 35 mph impact speed. All test results are presented without analysis or discussion. Included are the still photographs, the electronic data in plotted form, vehicle damage sketches and tabulated pre-test and post-test dimensions, accelerometer location identification, and summaries of the simulated occupancy data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the sponsor.

by E. Enserink
Dynamic Science, Inc., 1850 West Pinnacle Peak Rd.,
Phoenix, Ariz. 85027
Contract DOT-HS-5-01104
1977; 63p
Availability: Reference copy only

HS-803 230

ACCIDENT AND NEAR ACCIDENT CAUSATION: THE CONTRIBUTION OF AUTOMOBILE DESIGN CHARACTERISTICS. APPENDIX D, QUESTIONNAIRE ANALYSIS RESULTS

Tabulated data present results of a questionnaire used in study of "real-world" consequences of driver/vehicle mismatches. Types of problems considered included limited vision because of various factors, blocking of vision by various parts of the car or by passengers, driver seating arrangement, braking problems, relationship of pedals to feet, steering difficulties due to various factors, confusion due to being in an unfamiliar car, and ability to find controls or reaching operating them. Data were also gathered on features desired the next car purchased, number of close calls or near accidents in the two months preceding the survey, body style car owned, and its equipment. The most frequent and severe problems which contribute to accidents are oncoming headlight glare, window obscuration due to weather, and mirror information. Steering and braking problems were also significant.

by Michael Perel
Dunlap and Associates
Contract DOT-HS-5-01216
1977; 178p
Availability: Reference copy only

HS-803 232

DEVELOPMENT OF A STANDARDIZED VEHICLE IDENTIFICATION NUMBER. FINAL REPORT

Objective, systematized information was developed for use by the National Hwy. Traffic Safety Administration (NHTSA) to decide the most advisable characteristics of a standardized vehicle identification number (VIN) system. A systems analysis of the VIN system was made to determine how the code employed by user organizations. A framework was developed for uniform data collection and for assessing the impact

coding errors. Data needs of users were determined, as were the relative priorities for specific data. The significance of erroneous VIN's was assessed, and various means for correcting the code were identified. An assessment was made of the impact on users of a standardized format for VIN's. The psychological literature was reviewed on alphanumeric codes and on character legibility. Experimental comparisons were made of selected codes and cost/benefit issues were considered. VIN users can be categorized by their activities: operational users, such as manufacturers; analytical users, such as researchers; and monitoring users, such as the Dept. of State. Most errors in VIN transmission relate to lack of standardization in the VIN, lack of standardized training materials for all users, insufficiency of verification processes, and poor physical characteristics of VIN plates and imprints. The total requirement for users, as analyzed in this study, is a 15-character VIN, including three characters for the manufacturer code (WMI), seven characters for the production year code and sequence number (VIS), two characters for make and body style, and two characters for contingency data for temporary needs. Large automobile manufacturers expressed a need for an 8-character VIS code to identify the plant from which a vehicle originated. Further experiments are recommended to determine the best physical format for the VIN and to avoid errors in transmission by CRT terminal, by handwriting, and by oral communication.

Planning and Human Systems, Inc., 3301 New Mexico Ave.,
N.W., Washington, D.C. 20016
Contract DOT-HS-7-01541
1977; 104p 87refs
Rept. for Dec 1976-Oct 1977.
Availability: NHTSA

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General Motors Res. Labs., 12 Mile and Mound Roads, Warren, Mich. 48090

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Calspan Corp., Transportation Res. Dept., Buffalo, N.Y.
14221

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Pennsylvania State Univ., Pennsylvania Transportation Inst.,
University Park, Pa. 16802

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Naval Aerospace Medical Res. Lab. Detachment, P.O. Box
29407, New Orleans, La. 70189

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University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48109

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University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C. 27514

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University of North Carolina, Hwy. Safety Res. Center,
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Institute for Safety Analysis, 6400 Goldsboro Rd., Washing-
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National Public Services Res. Inst., 421 King St., Alexan-
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New Mexico State Univ., Physical Science Lab., P.O. Box
3548, Las Cruces, N. Mex. 88003

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